MINISTRY FOR
INNOVATION AND TECHNOLOGY

TRANSPORTATION SAFETY BUREAU

FINAL REPORT

2018-0679-5
Railway incident / Runaway of a vehicle

Majláth (Miskolc)
11 June 2018

This investigation has been carried out by Transportation Safety Bureau on the basis of

- Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents (hereinafter referred to as Kbvt.),
- MND Decree 24/2012. (V.8.) on the detailed rules of the technical investigation of serious railway accidents, railway accidents, and railway incidents and on the detailed rules of investigation by the upkeeper, and
- in the absence of other related regulation of the Kbvt., the Transportation Safety Bureau of Hungary conducted the investigation in accordance with Act CXL of 2004 on the general rules of administrative authority procedure and service.

The Kbvt. and the MND Decree 24/2012. (VI.8.) jointly serve compliance with the following EU acts: Directive 2004/49/EC of the European Parliament and of the Council of 29 April 2004 on the safety of the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive).

The competence of the Transportation Safety Bureau of Hungary is based on Government Regulation 278/2006 (XII. 23.), and, as from 01 September 2016, on Government Regulation № 230/2016 (VII.29.) on the assignment of a transportation safety body and on the dissolution of Transportation Safety Bureau with legal succession.

Under the aforementioned regulations

- The Transportation Safety Bureau of Hungary shall investigate serious railway accidents.
- The Transportation Safety Bureau of Hungary may investigate railway accidents and incidents which – in its judgement – could have led to more accidents with more serious consequences in other circumstances.
- The technical investigation is independent of any administrative, infringement or criminal procedures commenced in connection with a transportation accident or other occurrence.
- This Final Report shall not be binding, nor shall an appeal be lodged against it.

Incompatibility did not stand against the members of the IC. The persons participating in the technical investigation did not act as experts in other procedures concerning the same case and shall not do so in the future.

The IC shall safe keep the data having come to their knowledge in the course of the technical investigation. Furthermore, the IC shall not be obliged to make the data – regarding which the owner of the data could have refused its disclosure pursuant to the relevant act – available for other authorities.

This Final Report

was based on the draft report prepared by the IC and sent to all affected parties (as stipulated by the relevant regulation) for comments. Simultaneously with the sending of the draft final report, the Director General of TSB Hungary informed the people involved on the date of the closing meeting, and also invited all such people and organizations to such meeting.

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DEFINITIONS AND ABBREVIATIONS

ERAIL	Accident database of the European Railway Agency
TSB	Transportation Safety Bureau
Kbvt.	Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents
Excl.	Excluded. (When applied after the name of a railway station it means the affected line section shall be as far as the station mentioned, but not including it.)
knyk.	Narrow-gauge line
LÁEV	State Forest Railways of Lillafüred (managing company: Északerdő Zrt.)
MVK	Miskolc Városi Közlekedési Zrt. (the community transport company of Miskolc City)
NTA	National Transport Authority (legal predecessor of Railway Authority Division, Ministry for Innovation and Technology)
IC	Investigating Committee

CONTENTS

SUMMARY

Occurrence number:	2018-0679-5
ERAIL identification:	HU-5687
Occurrence category:	Railway incident
Nature of occurrence:	Runaway of vehicle
Date & time of occurrence:	11 June 2018, 01:28
Location:	In Miskolc between Majláth Station (LÁEV) and LÁEV Stop (MVK Zrt.)
Type of railway system:	Regional / narrow-gauge railway
Type of movement:	Runaway of vehicle vs. tram
Number of persons deceased / seriously injured as a consequence of the occurrence:	0 / 0
Infrastructure manager:	Északerdő Zrt. and Miskolc Városi Közlekedési Zrt.
Operating entity:	Északerdő Zrt. and Miskolc Városi Közlekedési Zrt.
State of registry:	Hungary
Number of the vehicle and service involved	Runaway of vehicle; 1V
Degree of damage (value)	the buffer stop broke, one passenger wagon became scrap , and another was damaged; the tram was badly damaged
Legal basis of the investigation	Article (2)a, 2004/49/EC

Location of the occurrence

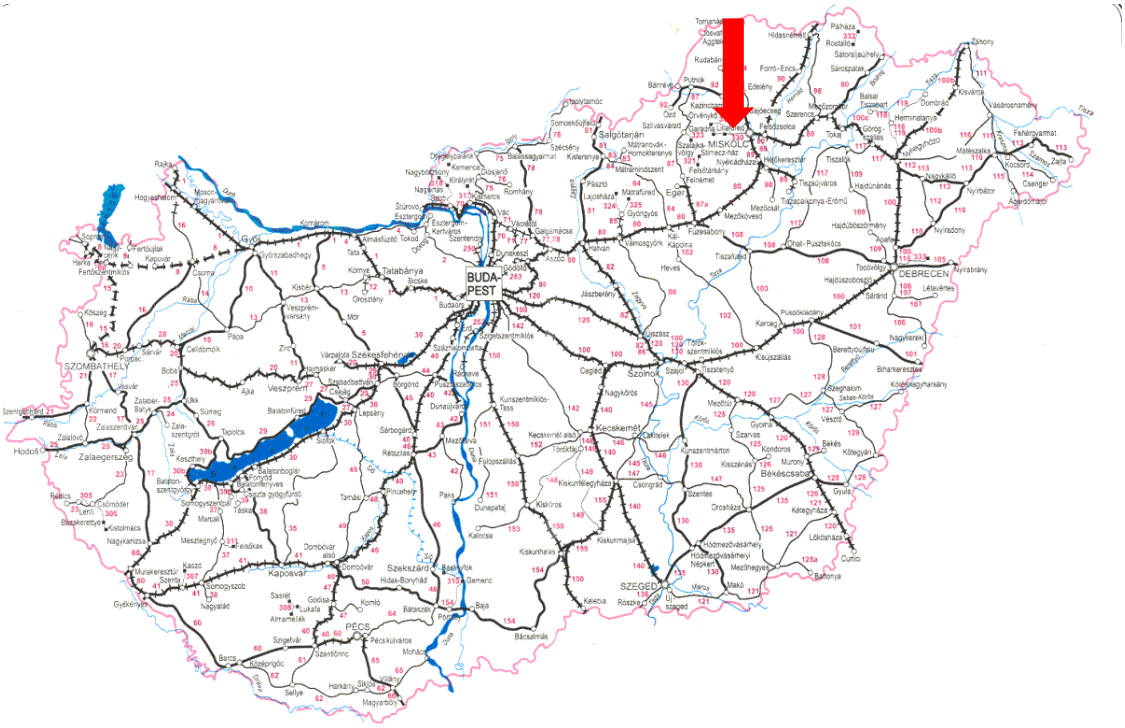


Figure 1: Location of the occurrence in the railway network of Hungary

Figure 2: A closer view of the scenes of the occurrence

Reports and notifications

The occurrence was reported to the Duty Service of TSB by the dispatcher of MVK Zrt. on 11 June 2018, at 01:38 (10 minutes after the time of the occurrence).

A LÁEV runs no night duty, thus no report arrived from them. The Head of Service at LÁEV was informed on the occurrence by an investigator of TSB.

Investigating Committee

The Head of TSB appointed the following investigating committee to perform a technical investigation of the railway incident.

Investigator-in-Charge:	Gábor Chikán	Investigator
Members:	József Kovács	Investigator
	Csaba Sárik	Investigator
	Flórián Gula	Investigator

József Kovács' employment by TSB was terminated during the investigation, on 30 November 2018.

Overview of the investigation process

The IC viewed the scene of the occurrence on 11 June 2018, where they

- investigated the scene of the occurrence;
- interviewed the crews involved in the occurrence: two locomotive drivers, a crew member in charge, a brakeman, and a traffic manager.

During the investigation, the IC

- received video camera records taken at the scenes of the occurrence;
- met the management of the railway company (manager, traffic manager) and the CEO and the technical staff of the forestry company (Északerdő Zrt.) which is also a railway company;
- modelled the data of the movement of the runaway vehicle;
- obtained the staff assignment and also had a theoretical staff assignment prepared.

Closing meeting

Comments were made in writing to the draft Report by:

- MVK Zrt.: they corrected editing and wording errors.
- Északerdő Zrt.: in addition to corrections of wording, they also commented on the contents of certain findings. Some of their comments were not accepted by the IC, so the differences of opinions were settled at the closing meeting.
- Railway transport authority: in addition to corrections of editing errors, one comment was related to the contents of the findings. As a result of discussing the problem at the closing meeting, the IC partly modified the Final Report.

Representatives of National Transport Authority, Északerdő Zrt. and MVK Zrt. attended the closing meeting held on 3 September 2019.

Short summary of the occurrence

At the dawn of 11 June 2018, in Miskolc, two passenger wagons stopped for the night on the night before at Majláth Station of LÁEV broke away and, after rolling 2.4 km, they broke through the buffer stop at the terminal depot in Dorottya street. After the buffer stop, the wagons rolled out towards the tram track, crossed the road, and finally crashed to the side of a tram which was just moving along there. The tram derailed, and one of its passengers had minor injuries.

The IC attributed the occurrence to simultaneous absence of several elements of securing the rolling stock against runaway. But this was a usual practice within the Railway Operations, and the technical management failed to check and enforce the staff's keeping to relevant procedures.

The shortcomings of the management's activity may be related to overload of the staff as well as to earlier changes to the staff of the railway company, and also to the low level of cooperation within the management.

As the railway company made a number of changes relating to the occurrence, TSB will issue no safety recommendation.

1. FACTUAL INFORMATION

1.1 History of the occurrence

At the dawn of 11 June 2018, in Miskolc, two passenger wagons stopped for the night on the night before on Track № II at Majláth Station of LÁEV broke away. The wagons rolled past the open red-white track barrier installed at the up side of the station, broke through the gate of the gate of the depot, and, after rolling 2.4 kilometres, they broke through the buffer stop at the terminal depot in Dorottya street. After the buffer stop, the wagons rolled out towards the tram track, crossed the road, and finally crashed to the side of a tram number 1V (reg. №: 614) which was just moving along there and derailed it.

1.2 Consequences

1.2.1 Injuries to people

Injury	Crew	Passenger	User of level crossing	Passer-by	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	1	-	-	-
Uninjured	1	-	-	-	-

The only passenger of the tram who suffered minor injury suffered no physical injury in fact, but needed medical help due to psychic shock.

1.2.2 Damage to payload or baggage

There was no damage to payload or baggage.

1.2.3 Damage to rolling stock

LÁEV's passenger waggon with reg. № 308 became scrap due to bending of the main frame, it became a complete write-off.

According to data available, LÁEV's passenger wagon with reg. № 305 is probably repairable, but it requires a more thorough inspection, which is not possible at the time this Report is worded (5 December 2018) because the wagons have been seized by the police.

The value regarding damage to the tram was given by the operating company as EUR 1 million, based on damage assessment.

1.2.4 Damage to railway infrastructure

The damage to the track of the narrow-gauge track was about EUR 455.

The affected tram track section suffered insignificant but repairable damage to the pavement; the operating company could not give the value of the damage on 27/06/2018 yet.

The suspension system in the overhead supply line broke, which caused a damage of EUR 60.

1.2.4.1 Other damage to railway traffic

Traffic was suspended on the Miskolc – Lillafüred – Garadna railway line (7 pairs of passenger trains were cancelled) due partly to temporary reconstruction of the track and partly to the inspection along the line (which was hindered by the reconstruction works) because

of the heavy showers that had occurred at the dawn, and also to the related damage assessment. The trains continued service according to schedule from the day after.

There was service fall-out along the line of the tram number 1V between the stops Gimnázium and Felső-Majláth from 01:40 to 11:50, 65 rounds were cancelled. Due to necessary replacement of the tram by buses, 4 bus rounds were cancelled completely and 3 partly.

The cost of replacement was EUR 2,727.

1.2.5 Damage to the environment

There was no damage to the environment.

1.2.6 Other damage

The removal of wrecks cost EUR 1,675 to LÁEV, and EUR 3,355 to MVK.

1.3 Scene of the occurrence

The runaway run started at Majláth station and finished after the buffer stop, at the station in Dorottya street where the railway wagons crossed the road and collided with the tram running there and caused it to derail (Figure 3). During the investigation of the scene after the occurrence, it was found that the brake nuts on the brake spindles of the parking brakes of both passenger wagons were in the lower position, and a rail skid was also found on the brake platform of the wagon with reg. 305 (Figure 4).

Upstream of some half-ruined freight waggons stopped long ago and secured with rail skids (Figure 5), there were 3 passenger wagons in two groups without being secured either with rail skids or dunnage (Figure 6) on Track III at Majláth Station. On Track I, upstream of some freight wagons pushed against the buffer stop (in the direction of an upward slope), stood a group of wagons, again without being secured either with rail skids or dunnage

Figure 3: View of the wrecks at the scene of the collision

Figure 4: The brake spindle and a rail skid on the passenger wagon with reg. № 305

Figure 5: Half-ruined freight wagons stopped long ago and secured with rail skids on Track III at Majláth Station

Figure 6: Wagons stopped without any rail skids applied on Track III at Majláth Station

As a result of the occurrence, the axles of the middle running gear frame (part D) of the tram with reg. № 614 derailed and stopped 1.5 metres from the track.

1.4 Description of the infrastructure

1.4.1 Infrastructure data

The Miskolc, Dorottya u. Miskolc – Lillafüred – Garadna railway line (track gauge: 760 mm), running through forests, currently provides passenger transport for touristic purposes only. The depot is at Majláth Station (not open for passenger traffic) which is the next station after Dorottya street.

The buffer stop of the station Dorottya street, Miskolc is in the section № 0+00. The route of the runaway includes a point where the numbering of sections changes: at the section № 3+80 it starts again with 0+00. (Accordingly, the road data of the buffer stop is -380 m in the diagrams.)

The railway track between the stations Majláth and Dorottya street descends almost all along the line: the altitude difference between the two stations is 23 m. The speed limit for the track section is 20 km/h.

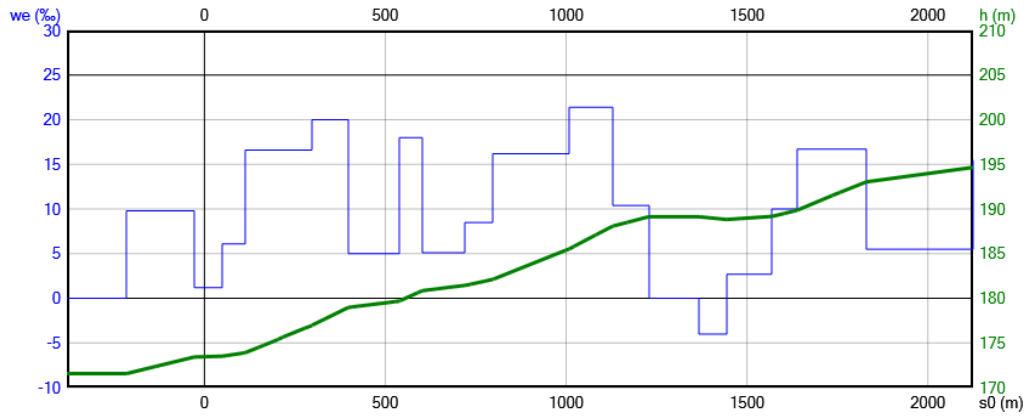


Figure 7: gradients between the stations Dorottya u. Miskolc and Majláth; blue: degree of ascension; green: longitudinal section

1.4.2 Station data

1.4.2.1 Dorottya street, Miskolc

The tracks of the station can be seen in Figure 8. In its home position, the switch № 1 directs the train in the turnout direction, i.e. towards the platform. Next to this station is a stop (called "LÁEV)" on the line of the tram number 1V of MVK Zrt.

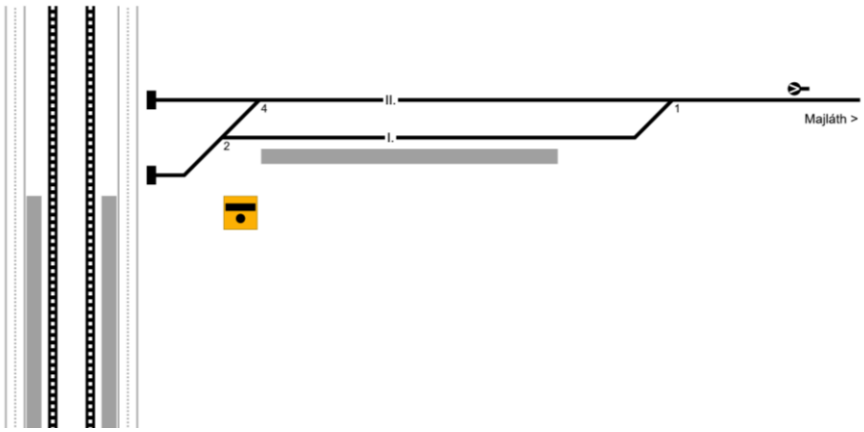


Figure 8: Distorted sketch of the tracks in Dorottya street, Miskolc Station (the tram tracks are on the left)

1.4.2.2 Majláth

The tracks of the station can be seen in Figure 9. The main track is Track II; the common shunting limit signal of the tracks I and II at the down-side end is located in the section № 20+85.

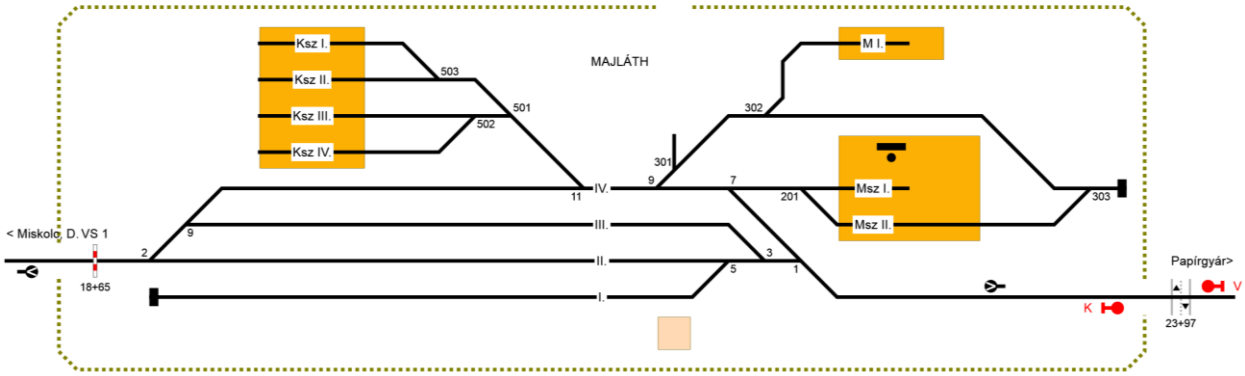


Figure 9: The track system of Majláth station

This station hosts (in a building shared with the locomotive depot) the management offices of the Railway Operations, comprising two rooms with a total area of 19.7 m^2, and providing workstations for 4 people at the time of the occurrence. Next to these offices is the traffic manager's office in a room of 15.7m^2 which is also serves as passage to the workshops and the welfare facility. The traffic of the lines Dorottya street, Miskolc (excluded) – Lillafüred (excluded) and Papírgyár – Mahóca is managed from here, and the warning lights in the section number 23+97 supported with light signals are also controlled from here.

1.4.3 Protective installations

At the up-side end of Majláth Station, just inside the fence of the depot, is the red-white track barrier number VS1[1], in the section number 18+65.

Figure 10: The red-white track barrier and the gate forced open by the runaway wagons, in the morning after the occurrence
(the position of the gate leaves in the photo do not reflect the direction of roll of the wagons)

In 2016, an external enterprise was assigned to perform track repair works (replacement of sleepers, making up of ballast, levelling of the track), for which the path of the red-white track barrier had to be removed; however, its restoration was not included in that contract.

The path of the red-white track barrier was restored later on, on the basis of a contract signed in 2017, and then the installation was ready for use again.

1.5 Vehicle characteristics

Type of movement:	Tram (№ 1V)	Runaway of vehicle
Line route:	Tiszai pu. – Felső-Majláth	Majláth – Miskolc, Dorottya u.
Composition:	Skoda 26THU3 614	308, 305[2]
Length:	32.1 m	24 m
Mass:	42.6 t	20 t

In the evening before, the runaway wagons arrived at Track II, Majláth Station at 19:00 (according to data in the journey log), in a train without any number ("RK" in the journey log entry).

1.5.1 The runaway vehicles

Both of the wagons involved were built on the undercarriages of Jah series freight waggons in 1972 (4 similar wagons were built altogether).

The wagons are equipped with manual brakes and with automatic air brakes. Originally, the pneumatic brake system was designed with a two-stage distributor valve, but, in 2013,

[1] The numbering is different from that used with Hungarian railways (according to that, it would be VS2).
[2] The 12-digit registration number of the wagons has not been issued by the transport authority to date.

it was reconstructed for three-stage distributor valve type KE1, within a project (started in 2013) of the company which addressed installation of pneumatic brakes in all rolling stock of the company.

1.5.2 Data recorders

The runaway wagons are not equipped with data recorder.

The speed data readouts from the data recorder of the tram are shown in Figure 11.

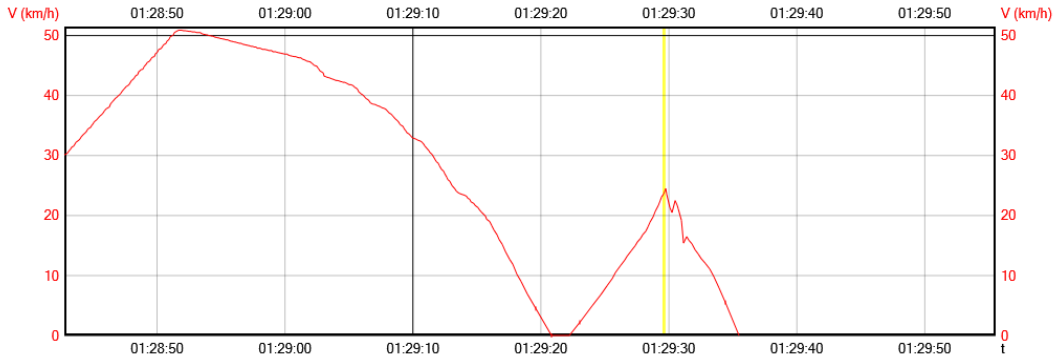


Figure 11: Speed data of the tram

1.6 The people involved

1.6.1 Vehicle drivers

Of the staff the narrow-gauge railway, two staff members were affected: the locomotive driver who had pulled the two runaway wagons to Majláth Station on the day before, and the so-called reserve locomotive driver assigned to that train on the same day.

Vehicle driver:	Tram driver	Locomotive driver of the train	Reserve locomotive driver
Age:	61 years	58 years	59 years
Gender:	Male	Male	Male
Locomotive driver test passed:	in 1984	in 1980	in 1979
Basic examination:	Valid	Valid	Valid
Line knowledge:	Valid	Valid	Valid
Knowledge of the vehicle type:	Valid	Valid	Valid
Medical certificate:	Valid	Valid	Valid
Start of duty:	10 June 19:51	10 June 7:30	10 June 7:30
End of duty:	At the time of the occurrence	19:30	19:30
End of previous duty:	10 June 03:30	19:30 on the previous day (as reserve, so he did not drive)	06 June 19:30

On his workday, the locomotive driver of the train drives from about 08:30 till 19:00, with short breaks at the turns at the terminals.

The reserve locomotive driver did not drive on the workday indicated in the table above.

1.6.2 Train crew

Position:	Crew member in charge	Brakeman
Age:	39 years	31 years
Gender:	Male	Male
Qualifications:	Train crew member on narrow-gauge railway vehicles (2016)	Train crew member on narrow-gauge railway vehicles (2017)
Medical certificate:	Valid	Valid
Start of duty:	10 June, 07:30	10 June, 07:30
End of previous duty:	19:30 on previous day	19:30 on previous day

Their duty roster of the 10 days preceding the occurrence:

Day		**Crew member in charge**		**Brakeman**	
		Activity	**Working hours**	**Activity**	**Working hours**
1 June	Fri	Traffic manager	12	Brakeman	10
2	Sai				
3	Sun			Brakeman	10
4	Mon	Traffic manager	12		
5	Tue	Crew member in charge	12	Brakeman	12
6	Wed	Crew member in charge	10	Brakeman	10
7	Thu	Crew member in charge	10		
8	Fri			Brakeman	12
9	Sat	Traffic manager	12	Brakeman	10
10	Sun	Crew member in charge	12	Brakeman	12

1.6.3 The Traffic manager

Age:	32 years
Gender:	Male
Qualifications:	Train crew member on narrow-gauge railway vehicles (2016) General traffic management on narrow-gauge railway (2017) “Independence Examination” in traffic management on narrow-gauge railway (Autumn 2018, i.e. after the occurrence)
Medical certificate:	Valid
Start of duty:	10 June, 07:30
End of previous duty:	08 June, 19:00

At the time of the occurrence, he was preparing for a so-called independence examination which was necessary for his work as traffic manager. He had completed the required practical training in the spring of 2018, and the theoretical part of the training was to take place in the summer of 2018, but it had to be postponed to the autumn because of the occurrence.

1.6.4 Management of the Railway Operations

Position:	Plant Director, Railway Operations Manager	Head of Service
Age:	59 years	37 years
Gender:	Male	Male
Qualifications:	Railway Operations Manager	Railway Operations Manager, Locomotive Driver, Practical Railway Instructor, Accident Investigator
Professional experience:	With the forestry company since 1982 (not in positions related to the railway), and in this position with LÁEV since 2002	With MÁV Rt. previously; with LÁEV since 2002, and in this position since 2003.

The employment of the Railway Operations Manager and the Head of Service was terminated during the investigation.

1.7 Traffic circumstances

Figure 12 shows the timetable of the affected railway line on the day preceding the runaway. Two trains performed service; the trains move without passengers from Majláth Station to Dorottya str. Station at the start of service, and return there at the end of service.

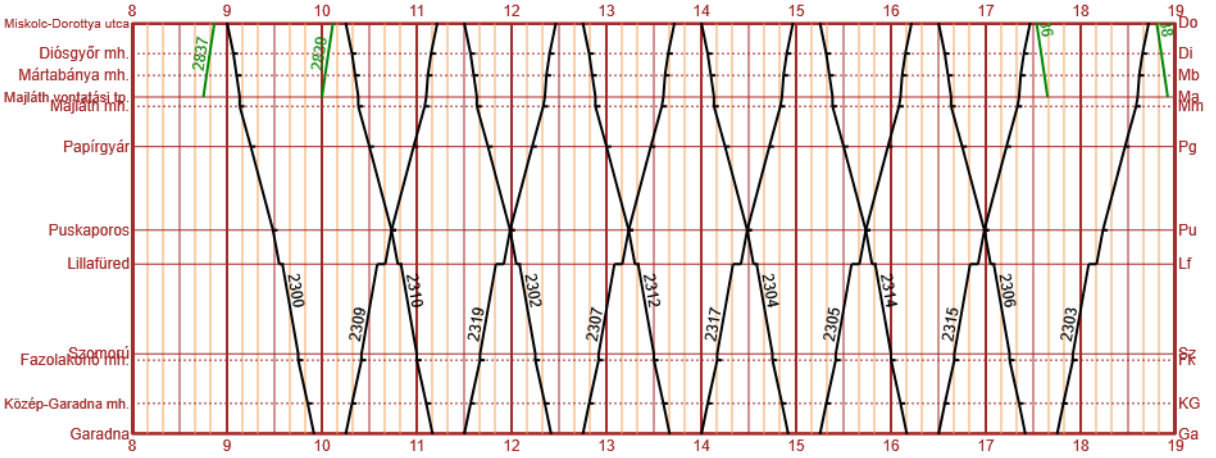


Figure 12: Timetable on the workday 10 June

1.8 Organisations affected

The narrow-gauge railway is operated by Északerdő Zrt. The main activities of the company are forestry, and hunting, and it also offers services related to tourism[3] such as operating two forest railways. The company consists of a General Directorate (central unit) and some directorates.

LÁEV Directorate is one of such directorates, headed by the Director who was the same person as the Railway Operations Manager (as the position is designated in railway terms) at the time of the occurrence. The Head of Service (who was also qualified as Railway Operations Manager), played a determining role in the professional management of the railway activity.

[3] also Pálházi ÁEV, located in the Zemplény Mountains, in addition to Lillafüredi ÁEV which was involved in the occurrence.

Within the General Directorate, the Technical Department plays a determining role from the aspect of railway operation. That unit, in addition to its various tasks related to forestry, takes part in the preparation of long-term, strategic decisions for the Railway Operations, but also provides assistance with issues of day-to-day operation. The Technical Department is also responsible for making the annual investment and maintenance plan of the Company (after collecting data from the various units), and they compile the proposed plan in consultation with the various units.

Similar to the Technical Department, LÁEV Directorate is also subordinated directly to the Director General, as seen in the Organigram.

1.9 Description of organisation of work

The operation of the Railway Operations is organised in a way similar to other railway companies, with the differences based on tacit consensus as described on other chapters below.

1.10 Rules and policies

1.10.1 Protection of rolling stock against runaway

According to Section 7 Protection against Runaway, Part II, Signalling, Traffic Management and Mechanical Instructions for Forest Railways:

> "Protection against runaway is the responsibility of the shunting crew or train crew. In the case of trains stopped at a terminal, and for vehicles left stationary after shunting:
>
> - the vehicles shall be linked together within the shunting limit signals;
> - on stationary vehicles, the hand brakes necessary for keeping stationary (Part III), [sic! – the IC]
> - dunnage or double rail skid shall be placed under the wheels of vehicle groups (single wagons) at the end where the buffers are free;
> - if possible, the points shall be switched to a positon which leads to a dead-end track or other siding;
> - a red-white track barrier or derailers shall be placed on the track and secured there."

1.10.2 How to stop runaway vehicles

According to Section 7.2 How to Stop Runaway Vehicles, Part II, Signalling, Traffic Management and Mechanical Instructions for Forest Railways:

> "For the purpose of stopping runaway vehicles, 2 double rail skids shall be kept available at the railway station (except where not even temporary service is provided). One double rail skid or two single rail skids shall be kept available on traction vehicles."

1.10.3 Delegation of tasks

According to Section 1.1 Responsibility, Part II, Signalling, Traffic Management and Mechanical Instructions for Forest Railways:

> "An employee who is on duty shall not delegate his/her own tasks to another person (except for those tasks which may be transferred). Employees who are not on duty or who belong to other service units shall not interfere with the work of those on duty, except in case of emergency."

1.10.4 Assigning a foreman shunter

According to Section 6.1.1 Assigning a Foreman Shunter, Part II, Signalling, Traffic Management and Mechanical Instructions for Forest Railways:

> "The following persons may be assigned as foreman shunter:
>
> - the crew member in charge or a train crew member assigned by the crew member in charge,
> - the traffic manager,

- other employee who has been qualified for this task and is assigned for the task by the traffic manager."

1.10.5 The 'Local Annex'

The Local Annex to Signalling, Traffic Management and Mechanical Instructions includes no instruction for the keeping stationary of rolling stock.

Section 7 discusses the slope gradients of railway lines, listing the steepest slopes and level sections (0 ‰). It does not discuss the slope gradients of the stations.

1.10.6 'Book of Orders'

After the occurrence, the Railway Operations Manager issued orders in the Book of Orders.

- The order entered on 12 June under number 131 prohibits storage of rolling stock on the main track.
- The order issued on 14 June under number 132 is a photocopy (glued in) of the detailed written order given by the Director General to the Head of Railway Operations Manager the day before. Important elements of this are as follows (according to the original numbering):
    1. prohibition of leaving vehicles unattended for longer periods on Tracks II and IV;
    2. vehicles may be left unattended on certain track only for justified reasons, and only if secured by double rail skid;
    3. instruction to check presence of and replenish required devices (double rail skid, dunnage) as necessary;
    4. instruction to close the red-white track barrier № SR-1 and secure it by padlock;
    5. instruction to take action to obligate employees to use the means of preventing the runaway of vehicles;
    6. instruction to issue an instruction that the traffic manager should check and log the use of protection measures against runaway of wagons left unattended on the tracks specified in sections 1 and 2;
    7. instruction to issue an instruction that the default position of the switch number 11 shall be 'turnout', and it must be secured by chain and padlock at the end of operating time;
    8. Placing a Stop! signal at the place of the buffer stop at Dorottya str. Station, Miskolc.

1.11 Meteorology

Rain and wind

On the day before the occurrence, a summer instability system of northern origin was stuck and moving around over the mountains around Miskolc (its thunderstorms did not really reach the city in the afternoon yet); however, the system became of cold front character during the night, and, uniting into a squall line, it swept through the area. This resulted in heavy downpours on the plateau of the Bükk Mountains, but the quantity of rain in the affected area was 40 mm only, which is not unusual with thunderstorms; actually the three different meteorological stations, which record the timing of rains as well, showed that the rain in the affected area had fallen only after the runaway.

The aforesaid stations did not record very intensive winds running out from the thunderstorm, despite the fact that each station is located within a valley which is inclined to form a wind tunnel, i.e. not in the leeward side. (This does not contradict to the characteristics of the weather system described above.)

Temperature

At this time of the year, the highest daily temperatures in Miskolc usually are around 25°C, while longer periods with daily peaks over 30°C occur in ca. 3 years out of 10.

Such a sequence of high peaks had lasted for two and a half weeks by the time of the occurrence, with new records in three subsequent days, i.e. the temperatures had been extremely high in Miskolc for several weeks preceding the occurrence (Figure 13).

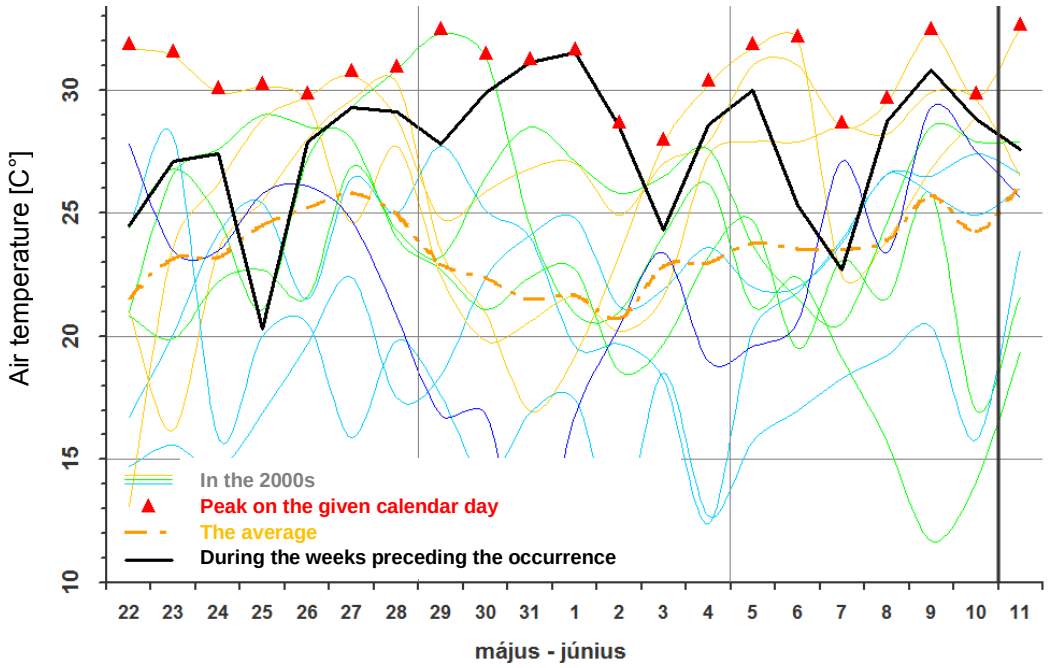


Figure 13: Daytime highest temperatures in Miskolc

In terms of physiological effects, the following circumstances should be mentioned:

- The sultry air caused by the thunderstorms around the area as well as the atmospheric tension caused by the stuck-up weather system could be perceived as warm front effect;
- Due to the situation of the home of the crew member in charge involved, the air temperature inside his home does not fall below 25°C even at night, which is already a limit for a full-value sleep.

1.12 Statements of people involved

The information from the interviews people is summarised below. If not otherwise stated, the information from different people was unanimous regarding the given issues.

Completion of the duty on previous day

In the evening before the runaway, the last passenger train arrived at Dorottya str. Station, Miskolc, at 18:43, and then returned to Track II, Majláth Station without passengers. Using the automatic air brake, the train stopped at the shunting limit signal, the locomotive driver disconnected the locomotive and braked the wagons. After refuelling the locomotive, the driver drove it to the engine shed and parked it there.

For health reasons, the locomotive driver was allowed to leave the train two hours before the end of the workday.

Day-to-day work

Hand brake

The wagons stored at Majláth Station are kept stationary using the hand brake only; braking is the responsibility of the brakeman who always performs the operation.

Rail skids

The rail skids distributed for the wagons are only used when a wagon has to be left unattended outside the Depot in Majláth (Most of them mentioned Garadna Station only). One of the interviewees mentioned the side tracks at Majláth station in this respect. In these cases, the hand brake is also secured by chain.

Neither double rail skid nor dunnage is in use.

Red-white track barrier (Majláth VS1)

It is the traffic manager's or the reserve locomotive driver's task to close both the red-white track barrier and the gate of the depot. As regards regular use of the red-white track barrier, the interviewees stated differently: 2 of them said they never used it, 2 of them said they used it sometimes, and 1 said he was using it regularly. The management did not know that it was not always used.

It was difficult to use the device, but it was reconstructed prior to the occurrence.

Supervisory inspection

There hardly any supervisory/managerial inspection during worktime, due to lack of capacity.

Other

Nobody knew exactly the gradient of the area of Majláth Station, their typical estimation was an inclination of 5-10‰ in the direction of the upside end.

An interviewed person mentioned that strangers may enter the depot site.

Company organisation

At the Technical Department at the Headquarters of the Forestry Company there are some staff members whose responsibilities include supervision of the railways as well. Their position is not superior to the Railway Operations Manager. The only hierarchal superior of the Railway Operations is the Director General; the Technical Department works to support his decisions.

Previously, some older staff members of the Technical Department performed those tasks, and had good personal relationship with the management of the Railway Operations. But they had all retired by 2017. No similar helpful atmosphere was formed between the new, younger staff replacing them and the management of the Railway Operations, and lot of disagreement occurred. However, no serious disputes were escalated to the Director General, their common superior.

If a task to be solved emerges at the Railway Operations, then a staff member of the Technical Department manages requests for quotations independently or assists the Railway Operations with their similar process. The Railway Operations may also submit proposals for decisions directly, without informing the Technical Department.

During the investigation, the IC received contradicting data relating to the following:

a) the Technical Department cannot override submissions from the Railway Operations;
b) however, it may occur, such as in the case of cancellation of the reconstruction of a culvert as mentioned in Section 1.16.3.

Decision criteria

As regards submissions for decisions, the Company is sensitive to prices, but if procuration is justified, then more expensive solutions may also be considered. An example is the warning lights installed in the Majláth area, where, upon proposal from the Technical De-

partment, the solution finally selected was more expensive but provided better service than the one initially proposed by the Railway Operations.

Staff

The Head of Service had lots of responsibilities, he performed several different functions (he took part in the daily traffic, and he was also district inspector, accident investigator, as well as instructor in practical training); however, his workload was perceived differently by those interviewed by the IC.

Prior to the occurrence, there was staff recruitment for the execution units where, upon a decision made at the Headquarters, more people were recruited (3+3 people on two occasions) than initially requested by the Railway Operations. Further recruitment would be justified; managers of the Railway Operations could not state an exact, well-grounded number though; according to a colleague from a unit other than the Railway Operations, the 16 staff members then available was sufficient.

Recruitment was prepared by the Technical Department. During that, they requested the management of the Railway Operations to help by providing existing data (e.g. daily timetables of various traffic periods, daily duty times, etc.). However, no such help was received from the management of the Railway Operations, so the Technical Department had to perform the necessary calculations on the basis of their own estimations. They also sent the results of their calculations for inspection and opinion to the management of the Railway Operations, but, again, no response was received. Then the Technical Department submitted their proposal (based in their own calculations) to the management of the Company and it was supported.

Developments

The following developments were performed using resources available earlier under various headings:

- within the framework of the air-brake program completed from 2003 to 2013, all passenger vehicles were equipped with air brakes;
- computerised ticketing was introduced;
- accessibility was improved by reconstructing a passenger wagon for better accessibility;
- based on special EU funding of a significant amount, a hybrid locomotive was developed, which first entered service on the 90th birthday of the narrow-gauge railway;
- significant track reconstructions were started in 2016;
- in 2016, 2 passenger wagons were reconstructed for the theme of hunting;
- the reconstruction of Dorottya str. Station, Miskolc, also began in 2016, as well as the purchase of a brand new passenger wagon.

At the time of the publication of this Final Report, track reconstruction and depot development is being prepared, and reconstruction of a vehicle is underway.

1.13 Rescue and elimination of damage

The two narrow-gauge passenger wagons damaged in the accident were lifted onto a trailer and carried to the Majláth depot by and external enterprise, using 2 cranes and on trailer, upon order from LÁEV Directorate, Északerdő Zrt. Technical Directorate, Északerdő Zrt. provided technical assistant with restoration, mainly by supplying minor parts. Restoration of the scene of the accident was finished by about 12:00, the authorities opened the affected road section to traffic at that time.

LÁEV Directorate implemented a temporary track blocking to substitute the damaged buffer stop of Track III, Dorottya str. Station, simultaneously with the removal of the wrecks; it had been also completed by 12:00.

Between 19 and 22 July, the temporary track blocking was removed during demolition of the old Track III (by a reconstruction which was part of a development project).

Technical rescue of the tram could only be started after the authorities investigating the scene had given authorisation to interfere with the scene, and after the passenger wagon (involved in the crash with the tram) had been removed from the tram by crane.

The bogie of the derailed tram was replaced on the track by employees (both those in the normal shift and those on standby duty) of MVK Zrt. Pályavasút üzem (Infrastructure Operations, MVK Zrt.). They used a hydraulic rescue unit and a tractor. Using a special tractor owned by MVK Zrt., they pulled the tram closer to the track (the rails), and then, using a special hydraulic re-railing device, they lifted the derailed axles onto the track.

The overhead contact line was restored by employees of MVK Zrt., using a tower wagon (owned by MVK Zrt.) specialised for overhead contact line works

1.14 Tests and research

The IC tested that some passenger wagons stationary at Majláth Station started to roll when their brakes were released. Due to damage of the wagons involved in the occurrence, other wagons were used for the test.

1.15 Additional data

1.15.1 Records of a security camera

There are camera records taken of the depot gate of Majláth Station (25 frames/sec.). On the basis of such records:

- On 10 June 2018 (the day before the date of the runaway), at 6:30 pm, the gate was closed, and the red-white track barrier was left open.
- On 11 June 2018, at 01:24:40 to 43 (96 frames), the first wagon passes along (Figure 14),
- the latter record shows a weak breeze.

**Figure 14: the runaway wagons in front of the gate,
and the desirable position of the red-white track barrier
(the open red-white track barrier is covered by the wagon)**

1.15.2 Rear-view camera of the tram

The IC obtained records of several cameras integrated in the tram. Records from the front right rear-view camera were used as discussed in Annex 1.

1.15.3 Rough-book for recording defects

The rough book for recording defects at the Railway Operations contains the comments and repair requests from employees from all specific areas. It includes, for instance, an entry in which an employee requests lubrication of the rollers of the red-white track barrier (Figure 15).

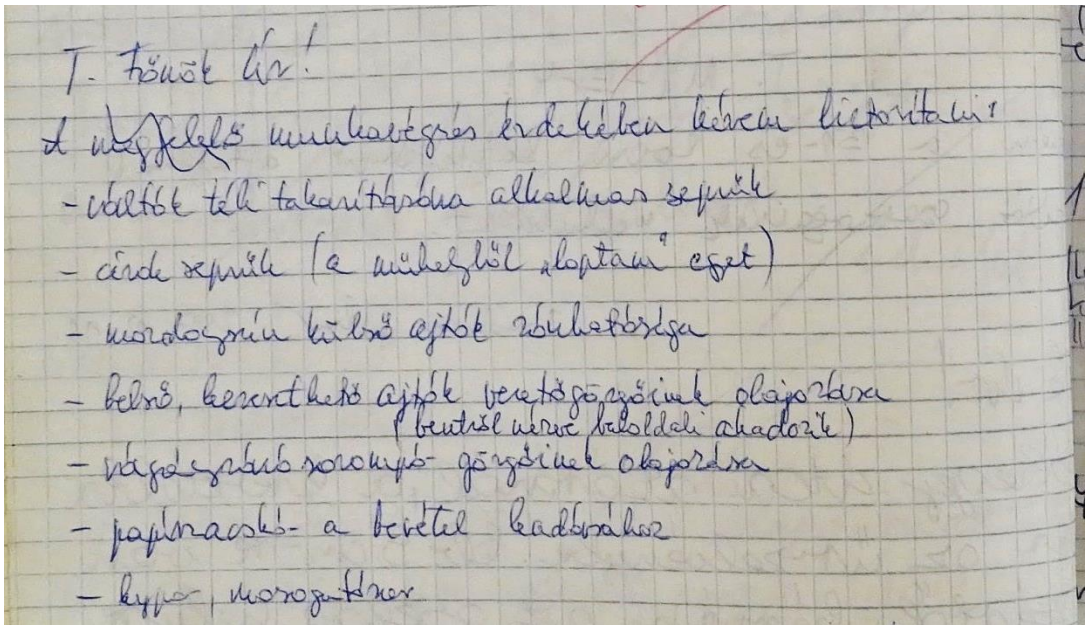


Figure 15: An entry in the rough book for recording defects

1.15.4 Control by authorities

The railway transport authority performed an audit on 05 July, and then, 62 days later, on 05 September, the authority issued its decision made relating to the case.

The basis of such audits is that the authority audits the operability of the safety management system of the affected railway company (but this does not affect the investigation performed by TSB).

Annex 2 to this Report includes the Decision made following the audit.

As a result of the said Decision, the railway company took actions as follows:

- submitted the requested reports relating to the railway activities performed on their two narrow-gauge railway networks;
- as regards medical fitness of their railway employees, they will ensure that each employee has a medical certificate complying with the requirements of the authority; and
- they began to obtain new types of driver's licences and certificates for their railway vehicle drivers.

1.16 Similar occurrences

1.16.1 09 December 2009, Devecser (2009-0627-5)

A freight train (pulled by two locomotives) carrying cola from Ostrava to Ajka-Bauxitrakodó was split up due to a slope on the rest of its route. After delivering the leading 12 wagons, the two locomotives returned to Devecser to pick up the other 12 wagons waiting there.

While the train was waiting for departure, its crew left it and went to the traffic control office, without shutting off or closing the locomotives. In the meantime, the train broke away due to inclination of the station area, burst the switch number 1 open, and rolled out in the direction of Tüskevár Station.

The train was stopped by the traffic manager of Tüskevár (after being notified), using a double rail skid, after taking action to stop another approaching train (№ 905) at the neighbouring station.

The investigating committee found that

- the train had not been braked properly,
- no brake test had been performed for the train, though it was not relevant to the occurrence, and
- the train crew had left the train in a way other than required by the relevant rules.

The investigating committee issued safety recommendations related to the occurrence, but they are irrelevant from the aspect of this occurrence.

1.16.2 10 October 2010, Hártókút (2010-0464-5)

Two passenger trains moved approaching each other and collided on the railway line of Királyréti Erdei Vasút (Forest Railway of Királyrét) at Hártókút station. Two passengers were injured seriously, and one had minor injuries.

The investigation revealed that the traffic management procedures are not applied, and the passing of trains running in opposite directions takes place fully on the basis of the awareness and the knowledge of timetables of the train crews.

The audit of the authority following the occurrence covered the licence documentations and found shortcomings only with the documentation of training, in addition to the absence of

the railway safety certificate[4]. The audit did not cover the actual state or operation of the technical systems, nor the traffic processes, and did not reveal the absence of traffic log-book and documentation of authorisations. TSB issued a safety recommendation for modification of the contents of the audits performed by the authority:

> *"BA2010-0464-5-01: The IC detected on the second occasion on the railway involved in the occurrence that basic shortcomings of operation processes had led to danger situations. The conditions of compliant work are not provided, and the execution staff does not apply the rules properly. Notwithstanding that, the audits performed by the authority are mainly focused on the availability of licences and documentations, but pay little attention to actual processes of operation.*
>
> Therefore the IC recommends National Transport Authority to consider placing the focus of their audit program for such Railway Operations/companies primarily on compliance with existing rules and availability of the conditions necessary for such compliance.
>
> *By acceptance and expected implementation of the safety recommendation a shift of focus to execution processes primarily determining railway safety could be achieved."*

National Transport Authority agreed with that safety recommendation; here is an extract from a letter from the Authority relating to some final reports of ours:

> "Of the final reports, only the Report № 2010-464-5 included a safety recommendation addressed to us, and we have communicated already that we agree with it. We will certainly take the recommended point into consideration as well during our railway safety controls."

1.16.3 27 March 2016, Lillafüred (2016-0344-5)

On 27 March 2016, the passenger train № 2302 derailed on an open culvert with longitudinal wooden support in the railway section 77+28.

TSB referred the investigation of the occurrence to the competence of the operating company, and the Head of Service of the railway company performed it at good standard in about 5 months. According to their conclusion, the occurrence was due to the poor state of the support beams of the open culvert in the railway section 77+28. Detection of the immediate danger of accident was hindered by the fact that no inspection walk had been performed along the railway line in the 6 months preceding the derailment.

Earlier, in November 2015, the contractor responsible for track supervision proposed that the culvert should be reconstructed: *"Reconstruction of a weakened, considerably worn-out open culvert with longitudinal wooden support (Section 77/78.)*". The management of the Railway Operations acknowledged the contrary opinion of Technical Department Északerdő Zrt., and the reconstruction was not ordered.

1.16.4 Further cases of derailment on a LÁEV line

Several derailment cases (with no injury to people) occurred on the railway line between 15 April and 05 August 2017, and TSB referred the investigation of such occurrences to the competence of the operating company.

In response to our call of 18 April 2017, on 19 June they requested delay of the deadline to 14 July, which was granted. Actually, they submitted their report on 05 February 2018 (discussing all of the occurrences together), but it needed to be complemented, so, finally, the report was accepted on 20 February 2018, which closed the process.

1.17 Investigation methods used

During the investigation of the occurrence, the IC used no non-conventional methods, however, they relied on software of own development which helped with construction of the flow charts that visualise the temporal as well as cause-and-effect relationships within the process (Annex 3).

[4] A change in legislation effective as of the end of 2010 abolished it.

Another software-based solution was used to model the running data of the runaway vehicles, and the resulting model gives a good estimation for the dynamics of the running of the vehicles involved.

2. ANALYSIS

2.1 Actual course of events

Based on evidence discussed in Chapter 1, the actual course of events looks as follows:

2.1.1 Antecedents of the occurrence

2002 The Railway Operations Manager at work at the time of the occurrence had been placed to his position by internal redeployment. At that time, a railway inspector helped his work at the headquarters of the company and provided him connection to the top management (1.6.4, 1.12). The Head of Service started to work in that position in the subsequent year.

They implemented a number of progressive developments in joint effort (1.12).

2011 Due to space requirements of the electricity development, the repair workshop of the Railway Operations was demolished. After that, repair activities were moved to existing buildings e.g. the wagon storage hall.

2010-2017 The earlier railway inspector and his successors retired, and the headquarters replaced them with young colleagues. That kind of mutually good relationship which had existed earlier between the predecessors did not evolve between the Railway Operations Manager and the new colleagues (1.12).

Disagreements not perceived by the management often occurred in the fields of development plans and operation (1.12). The management of the Railway Operations partly withdrew from the initiatives, and became more passive in the managing of everyday events.

> The IC noticed several details in the interviewees' reports which hinted at it. A good example is a recruitment program performed in 2016 and 2017 where some colleagues at the Headquarters took the initiative, while the managers at the Railway Operations withdrew from the decision-making process. During the investigation, the management of the Railway Operations was not able to specify a well-grounded demand for staff (1.12). Another decision was also mentioned unanimously, relating to the installation of warning lights, where the solution proposed by colleagues at the Headquarters was finally implemented, although it was more expensive than the one initially proposed by the Railway Operations, but it provided better service.

2.1.2 Course of events

The runaway wagons had performed 4 round trips between the stations Dorottya str. Miskolc and Garadna on the day preceding the occurrence (1.12, 1.7).

16:40 The brakeman left, with a good reason, the train which was in service between the stations Dorottya str. Miskolc and Garadna (heading to the end point) (1.12).

The train returned to Dorottya str. Station, its start-point (1.12, 1.7).

After 18:43: The trains moved without passengers from Dorottya str. Station to Majláth Stations (1.12, 1.7).

19:00 The traffic manager received the passenger train without passengers to Track II (1.5, 1.12). The locomotive driver stopped the train roughly in the section № 20+85 (1.4.2.2, 1.12).

The brakeman got off the wagons but he did not brake them with the hand brake.

> The IC found the brakes completely releases on the wrecks. This will not occur as an outcome of the collision, but only if the wagons were not braked, or if the brake was released due to vibration caused by motion of the vehicle. The latter is possible, but only in a wagon which is lightly braked, and only if the wagon has started beforehand (i.e. it was not adequately braked) (1.3).
>
> It is possible theoretically that the wagon was braked but someone released the brake subsequently. Due to the operation of the airbrake, such release could have happened even a longer time before the actual runaway. But, taking in account that the depot is closed, guarded, and partly equipped with surveillance

cameras, the IC gives that option very little chance. Actually there were some security problems before the technical upgrading of security guarding, but no such problems have occurred ever since (1.12).

Not dunnage or rail skids were placed under the wagons

The IC visited the station where 3 more wagon groups were stationary at the time of the site visit, but none of them was secured with rail skids. Each wagon group was braked with hand brake only, there was not even air in their airbrake systems (1.3).

The crew unanimously confirmed that the wagon set of the arriving train is never secured with rail skids at Majláth Station (1.12).

The crew member in charge disconnected the locomotive. The wagons were braked with the automated airbrake.

No direct evidence of the actual use of the automated airbrake is available, but

- the locomotive driver most probably used this mode to stop the train;
- when disconnecting the wagons, the operator usually also "taps" the main line in order to achieve a secure braking effect (1.12);
- it is also regarded a possible explanation why the wagons remained stationary for some time before breaking away.

The locomotive and the crew member in charge left the wagons behind (1.12).

The reserve locomotive driver locked the gates of the Depot, but the red-white track barrier was left open (1.12).

The traffic manager checked the closing of the gate by having a glimpse at the live camera image, but he did not regard the open position of the red-white track barrier a mishap, although it is also shown by the same camera (1.12). Now the wagons were situated at the Station as shown in Figure 16.

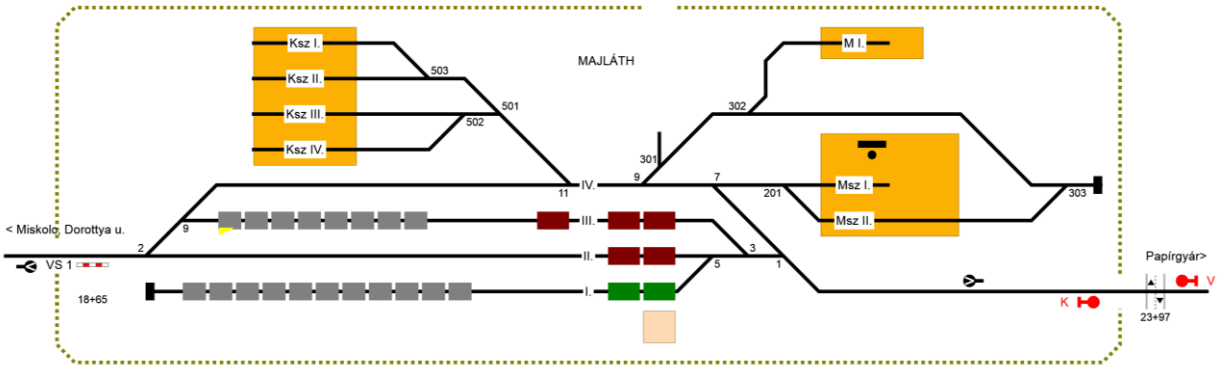


Figure 16: Majláth Station with the stationary wagons
(The figure excludes the vehicles stopped on the track of the wagon shed and locomotive shed, the number of grey wagons is not reflected exactly.)

* * *

The brake system of the wagons released, and the wagons started to roll down the slope.

It is a natural phenomenon in airbrake systems that, with time, some air leaks through spots of inadequate sealing. If leakage reaches a critical level, the braking force will weaken to such extent that it will not be able to restrain the wagon; actually, the braking force will completely disappear with time.

01:24:44 The wagons passed the open red-white track barrier (situated in section 18+64) and broke through the gate of the Depot. At that time, the speed of the wagons was ca. 11 km/h.

The speed of the wagons can be estimated on the basis of the camera record. The distance equalling the length of 11.6 m of the top of the leading wagon was covered while the camera recorded 96 frames; the frequency of recording is 25 frames/sec (1.15.1, 1.5.1).

At that time, the wagons were about 220 metres form their start place of (1.4.2.2).

The wagons rolled through Dorottya str. Station on Track I, as guided by the switches, and then broke through the buffer stop at the end of the truck at a speed exceeding 40 km/h (based on a simulation (1.17) the IC finds even a speed exceeding 50 km/h possible) (Figure 17).

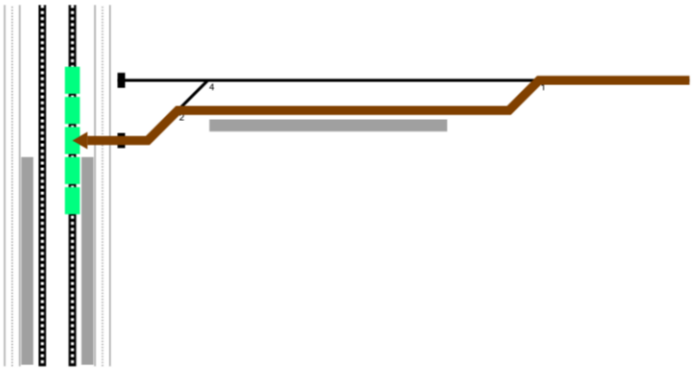


Figure 17: Miskolc, Dorottya str. Station, Miskolc with the track route of the runaway wagons and the tram

The speed of the wagon before the collision (38 km/h) was estimated on the basis of the camera record as described in Annex 1. The speed must have been even higher when they reached the buffer stop, and then it decreased due to the energy loss caused by the breakthrough and the subsequent terrain obstacles (1.15.2).

The duration of the breakaway from the red-white track barrier to the collision was 283 seconds, based on unproven time data of the camera records. On the basis of the IC's own mathematical model, such duration was ca. 240 seconds, with a speed of ca. 55 km/h at the buffer stop (1.17).

1:29:27 The runaway unit crashed to the side of the tram number 1, and caused it to derail. The tram had departed from its stop called LÁEV 7 seconds before, and its speed had increased to 24.5 km/h by the time of the collision (1.3, 1.5.2).

2.2 Cause and effect analysis of the occurrence

2.2.1 How runaway took place

Of the rules applicable to the prevention of runaway (1.10.1) it is important to highlight that, in the case of rolling stock left unattended:

a) if possible, set the switches to a position which leads to a dead-end track or other side track;
b) apply the hand brakes necessary for keeping the rolling stock stationary,
c) place dunnage or a double rail skid under the wheels of the affected group of vehicles;
d) Move the red-white track barrier onto the track and fasten it.

Viewing the process of the runaway, it can be seen that the occurrence was a consequence of several simultaneous mishaps and unsafe practices:

a) the wagons were stored on a track does not end in a buffer stop in the direction of the inclination (2.2.1.2) – by that, the possibility offered by the point a) above was lost;
b) the hand brake was not applied (2.2.1.3);
c) no dunnage or rail skid was placed under the wagons (2.2.1.4); and
d) the red-white track barrier at the station was not closed (2.2.1.4).

It is an inevitable consequence of this series of mishaps that, upon release of the airbrake, the wagons break away. The weather cannot have caused the wagons to start to roll (2.2.1.6).

2.2.1.1 The practice of protection against runaway of rolling stock

Based on statements by the crew (1.12), the interviewed crew stated unanimously about the following issues:

- it is the brakemen's task to apply the hand brake, **which they always do**;
- rail skids **are not used** at Majláth Station; the rail skids distributed for the vehicles are only used for wagons (almost everybody mentioned Garadna station as an example);
- the whole crew sounded uncertain when talking about the red-white track barrier: none of them said that he surely had used it, and none of them said that nobody used it (like they did relating to the rail skids). The traffic manager or the reserve locomotive driver was mentioned as the person obligated to use the device.

2.2.1.2 Selecting a track for storage

The runaway wagons had been stopped on the main track running through Majláth Station, although there are some tracks (e.g. tracks Nos. Ksz I to IV which are dedicated to the storage of rolling stock and which end in a buffer stop in the direction of possible runaway) (Figure 9). But there, due to limited capacity of the tracks, it would be more difficult to store the wagons: partly outside the shunting limit signal, which would hinder other possible necessary shunting movements.

As there is no further traffic after the train involved in the occurrence until the next morning, and in the morning that train is the first to start again, it does not obstruct any traffic when left on the main track, and even the shunting operation is simpler than the one needed to move it to the side track for the night.

The above storage technology was introduced after demolition of the workshop of the Railway Operations in 2011, as well as storage of wagons on the main track.

Such selection of a storage track was no against any rule; insisting on storing the rolling stock on dead-end tracks is only one of the various choices of careful, risk-avoiding operation. To the contrary, storage on the main track implies that protection against the risk of runaway requires stricter measures than in the case of storage on dead-end track which end in a buffer stop at the start-point end.

After the occurrence, it was ordered that wagons shall not be stored on the main track, and it has been a rule ever since (0).

2.2.1.3 Operation of the handbrake: a momentary human error

The crew member in charge usually brakes the wagons (1.12); although it is not part of his daily tasks, but when he has to do it, he has the appropriate skill. There is no reason to doubt his statement related to this, as the characteristic features of railway tracks in the mountains naturally necessitate that train crews be aware of the necessity of operation of the handbrakes, and also that they use the handbrakes in everyday practice. Otherwise, runaway would be a regular occurrence.

This activity of the crew member in charge was a skill-based activity: he had practiced it, it did not require the recall and application of any rule or procedure, nor did this regularly performed task require a conscious effort.

In the case of such activities, one of the risks is that the person responsible for the activity fails to do the given step, i.e. omits it. Such omission may be the result of several things. such as fatigue, interruption of the chain of activities, distraction of the attention, etc. According to the IC, that erroneous act of the shunting master might have been caused in this case by fatigue (the weather had been hot for several days already; it was the end of the

workday; he had worked 68 hours within 6 days of the week of the occurrence, etc.) or by some other, unidentified interruption of the usual activities.

Such occasional events of forgetting are a natural part of human activities, and preparedness and attention (or interference, disruption to the contrary) only influence the probability or frequency of such events.

Carefully designed and operated railway undertakings must take such margin of error into account, i.e. further protective measures related to safe operation are necessary.

Such additional protective elements are the following devices, which are included in the rules (1.10.1) but were not used in the case involved:

- securing device (rail skid, dunnage), and
- the red-white track barrier.

Daily routine

Railway work goes in airbrake mode, i.e. continuous handling of the handbrake during traffic is not part of the routine anymore.

Braking in order to keep rolling stock stationary is primarily the brakeman's task (1.12), so the crew member in charge only helps when there are many wagons (in order to brake several axles); but these locally evolved practices also include that managing the shunting movements is also the brakeman's job.

That is not against the rules, as the relevant instructions allow the transfer of the shunting master's tasks in the case of shunting (1.10.4); actually, it generally obligates the train crew to perform that task when it is about protection against runaway (1.10.1). For the latter case, however, it is not clearly specified which employee is obliged to perform the given task (it could be specified even in the local rules).

As in this way the crew member in charge does not always handle the parking brake (because the brakeman does it instead of him), the automatism to do this job before disconnection is not so strong on his part. This adds to the risk of error, and highlights necessity of additional protective measures.

2.2.1.4 Means of securing and their use

Means of securing

The use of securing devices (rail skids, dunnage) for the wagons disconnected at Majláth Station is not a routine operation (2.2.1.1). (Due to the gradient conditions of the Station, such means should be used at the up-side end, see also Section 2.5.1.) Such devices are only used outside the shunting depot: an unanimously mentioned example for that was Garadna Station where the wagons stored there occasionally are secured by means of rail skids and applying (and locking) the handbrake (1.12).

That is, the device is available: the IC even found the rail skids distributed for the runaway wagons (Figure 4). Therefore the absence of the device is not a cause of the omission of securing of the wagons against runaway, and the crew did not refer to it either.

(However, it should be noted that the rules specify double rail skid (or dunnage) (1.10.1), but only a single rail skid was available on each wagon. But, as a single rail skid would also have been sufficient to keep the wagons still, this fact cannot be related to the occurrence.)

Red-white track barrier

Crew statements suggest that the use of the red-white track barrier is fairly occasional (2.2.1.1); the camera records (1.15.1) also show exactly that it had not been closed at the end of the previous workday. Full non-use can be excluded not only due to crew statements

but also because the rough-book for recording defects also contains entries which will only occur in the case of use (or intended use) of the device (1.15.3).

The cause mentioned by the crew for not closing the red-white track barrier was that it was difficult to operate it (as suggested by an entry in the rough-book for recording defects), while the management mentioned that this problem had been eliminated by the reconstruction of the device (1.12).

The closing of the gates of the Depot and operating the red-white track barrier are principally connected in the relevant work process, as mentioned unanimously by those interviewed. While the gates were actually closed, and actually it never came up during the investigation that the gate would ever be left open (security goal), the operation of the red-white track barrier was typically omitted (safety goal). (Although security guarding of the rolling stock has safety effects as well, the closing of the gates of the site is a security measure).

This shows that the property guarding approach is strong, while the safety approach is less stressed.

The chance of work performed partially can be lowered by connecting two tasks closer physically, e.g. interdependence of keys or combination of two structures (a measure to the contrary was taken after the occurrence (0)).

The circumstances of the reconstruction of the red-white track barrier in 2016-2017 (1.4.3) also suggest that even the management did not find its use necessary: a track reconstruction work was ordered in such manner that the order did not include the subsequent restoration of the runway of the red-white track barrier which had to be demolished, so it was only restored in the next year, within the framework of another project. The latter also shows that there was at least one person in the organisation who identified the shortcomings and took action for restoration, but even that person could not enforce use of the device.

2.2.1.4.1 The employee responsible for performing the tasks

According to practice at the Railway Operations, closing of the gate of the depot and closing the red-white track barrier were the responsibility of the traffic manager, but, if there was a reserve locomotive driver at work, then he would perform these jobs, based on agreement (1.12).

In comparison, the relevant rules say that protection against runaway is "*the responsibility of the shunting crew or the train crew*" (1.10.1).

However, that wording is quite broad, as in the given situation it included:

- the locomotive driver,
- the crew member in charge of the train,
- the traffic manager, and
- the brakeman (who had left work earlier on that occasion).

There is a local practice of who of those above performs the tasks; actually, the tasks are even divided:

- application of the handbrakes: the brakeman or the crew member in charge,
- placing the securing device: nobody,
- closing the red-white track barrier (together with closing the depot gates): in principle the traffic manager, but in fact nobody, most of the time.

The local "unwritten understanding" extends the above broad crew list even further by involving the reserve locomotive driver for operating the red-white track barrier. However, such delegation of task cannot be inferred from the list of those obligated to provide protection against runaway, so the instruction expressly prohibits it (1.10.3).

If delegation is justified then it should be included specifically in the system of rules (2.5.2), clearly indicating also whether the delegating employee has to ensure proper completion of the task in that case as well.

The high number of the people involved and the possible alternatives not subject to specific conditions make the system uncertain anyway.

2.2.1.4.2 Enforcement of compliance

As the Instruction requires the use of securing devices and the closing of the red-white track barrier, and the Local Annex (1.10.5) contains no exemption for the omission of such devices, so the employees involved breached the applicable rules. (The situation is similar with the delegation of task.) However, this affects the whole crew: it has become part of collective mentality that those devices do not have to be used. The managers play a decisive role in it, as it would be their responsibility to:

- detect non-compliant work and put employees on the right path, and
- not tolerate that non-compliant work become "unwritten rule" followed by everyone, i.e. a routine-based error.

Managers may fulfil those tasks by regular inspections and the resulting disciplinary and/or organisational measures. Neither the management, nor the employees mentioned actual managerial inspection, which means that the management is not adequately aware of the prevailing working practice (1.12).

The enforcement of compliance showed shortcomings at the next lower tier, as the opinion of the IC is that even if the traffic manager delegates the task related to the closing of the red-white track barrier on the basis of local arrangements, he is obliged to ensure that the task has been fulfilled, which he can do easily using the security camera system - however, he tolerated the non-compliant practice. The basis of this clearly is that the unnecessity of such checks had been integrated in the collective mentality therefore he did not even regard it a mistake.

2.2.1.4.3 Limits of enforcement

The lack of managerial inspections and enforcement of compliance with rules can be traced back

- partly to shortage of capacity, and
- partly to the work organisation pattern in which a member of the management himself takes part in everyday shop-floor level operation, thus he meets the employees on a continuous basis without specifically targeted inspection activity as well.

Via the latter, he seems to supervise, but in this way he can easily become part of improper practices, and may accept them as normal, which then may allow employees to rely on improper practices with more confidence (1.12).

2.2.1.5 Spread of a non-compliant practice

The practice at the workplace (neither the securing means nor the red-white track barrier was used, etc.) was not the fault of the team only who had been working together for many years, but also that of the new traffic manager who also acquired that practice. This case implies a so-called routine-based error where some non-compliance becomes a routine and usual because nobody enforces compliance with certain rules. People may regard the rules unnecessary or may feel that the rules do not apply them.

The new colleague passed a general train dispatcher exam soon before (1.6.2) which included, among others, the knowledge when the red-white track barrier has to be closed. The practice and the habit of the working team are able to overwrite even the acquired the-

oretical knowledge (whatever deep it may be). An important human factor is that a newly entering employee may not want a conflict with a tight-knit old team, and accordingly, he may accept non-compliant work even consciously.

A related phenomenon is that the whole personnel of the Railway Operations had passed the periodical exams where they also proved that they knew the rules. This suggests that the local practice does not simply overwrite their knowledge but creates a "parallel world", a "double knowledge": there are the well-known rules, and there is a practice which they follow.

2.2.1.6 Weather impacts

The history of the railway has recorded several cases where an accident was caused by strong wind. Typically, lateral wind derailed rolling stock, but runaway also occurred occasionally[5]. The thundery weather prevailing at the time of the occurrence raised the possibility that strong wind had also been contributing factor. But the IC rejects it as a possible cause, for the following reasons:

- a meteorologist's opinion (1.11) reflects that there was no stormy wind at the time of the runaway (that can also be seen on the security video records (1.15.1));
- properly braked rolling stock cannot be set in motion even by stormy wind; in such a case, the wind would rather turn them over;
- the wind would advance the start of inadequately braked rolling stock (where the effect of the airbrake diminishes continuously) by a few minutes only, because they will start even without the wind.

2.2.2 Stopping of the runaway wagons

2.2.2.1 Options for the crew

The Railway Operations stops for the night, and there is no personnel at the stations. Therefore stopping the runaway wagons was not an option.

Dorottya str. Station Miskolc is staffed during service time, and the Instructions require that double rail skid be provided for such emergency situations (1.10.2), but such assets are not available at other stations.

2.2.2.2 Protection equipment

The buffer stop broken by the wagons was a simple structure welded together of rail pieces, with no flexible and/or energy absorbing structural elements.

A structure like this can stop a vehicle arriving at low speed, bearing the power of the collision owing to flexibility of the bumper of the wagon. Upon collision of a higher speed, however, the structure will break, not providing substantially more deceleration for the vehicle than the quantity given by the energy consumed by its break.

In the case of a buffer stop with expressly energy-absorbing structure, the device can stop a vehicle arriving at a significantly higher speed, but it also has limits, which suggests that one should not rely on it as primary means of the stopping of runaway rolling stock.

A more detailed risk analysis may reveal whether it is more favourable, in terms of safety and cost, to spend money on prevention of runaway instead of specifying and implementing a costly energy-absorbing structure, taking into account also the objects to be protected, such as pedestrian walk, road and tram track. (A simple pile of earth may also be used as a relatively low-cost buffer of energy-absorbing "structure" if it is shaped properly.)

[5] Dr. Horváth Ferenc: Hazai és külföldi vasúti balesetek [Railway Accidents in Hungary and Abroad]. Közlekedési Dokumentációs Rt. Budapest, 1995.

2.3 Actions taken after the occurrence

2.3.1 Book of orders

Following the occurrence, the Railway Operations Manager issued an order in the Book of Orders as a complementary additional safety measure (to be introduced in addition to the general rules) which included prohibition of storage of rolling stock on the main track (0). Previously he was ordered to do so by the Director General at a briefing.

Two days later, the Director General of Északerdő Zrt. issued also a detailed order with contents of railway technical nature to the Railway Operations Manager, which the Railway Operations Manager passed on, in unchanged form, as an order in the Book of Orders.

The contents of such order serve a clearly proper goal, prevention of similar occurrences:

- a measure to enforce the rules of work (Sections 4, 5 and 8 of the order mentioned in 0),
- a measure to procure missing assets (section 3), and
- a few complementary safety measures to be introduced in addition to the general rules (Sections 1, 2, 6 and 7).

However, it raises the following concerns:

- although the person who issued the order is a superior (as Director General) of the Railway Operations Manager, but does he have the right to issue an order of expressly railway technical nature, which privilege is subject to railway technical qualification?
- the Railway Operations Manager acted inappropriately when passing the received order unchanged through the Book of Orders, because even the wording of the order reflects that it was addressed to him and part of it did not even fall within the scope of responsibility of the operational railway personnel (inspection, purchases).

In the former case, the issuing of those orders requires consideration of possible side effects, which requires railway technical knowledge and detailed knowledge of the site. Certainly, the document was not prepared by the Director General but his subordinates having proper qualifications and knowledge, who probably had properly considered the problems concerned, but they were not the staff of the Railway Operations – thus, it does not make good the situation that certain powers delegated to the level of the Railway Operations Manager were interfered with. (In their comments made to the Draft Report of the IC, the Company mentioned that similar direct intervention into the management of the Railway Operations had not been a practice, neither before nor after the occurrence.)

The latter case originated in the personality of the Railway Operations Manager who wished to perform a decision of the top management with exaggerated automatism, thus largely giving up his decision-making powers and even his professional obligation to act. He visibly became a passive executor in a situation where, by virtue of his managerial responsibility, he should actively shape the activity of the railway unit (see also Section 2.5.4).

A conceptual problem is that, although the cause of the occurrence is the non-observing of a series of rules, the provision still brings additional (partly new) rules. The position of the IC is that the new rules may only be a success if, at the same time, the old rules will also be observed and if the management will enforce old rules as well.

2.4 Survivability

No immediate danger to life occurred during this runaway of vehicles, but that was only due to a favourable juncture of circumstances:

- the wagons crossed several level crossings where the users are obligated to make sure that crossing is safe, but
    - the unlit wagons are very poorly visible in the darkness,
    - the wagons approached the crossing much quicker than usual because their speed was about twice as much as their normal traffic speed.
- After breaking through the buffer stop, the wagons crossed a pedestrian walk and a main road.
- There was only one passenger on the tram, who was staying far enough from the point of the impact, thus avoiding physical injury (however, the passenger still needed medical aid due to a psychic shock) (1.2.1).

By daytime, a similar occurrence would affect busy streets and crowded trams, which would largely increase the chance of serious and mass casualties and such runaway vehicles might collide with a train coming from the opposite direction.

2.5 Other comments

2.5.1 Slope gradients

Proper use of the securing devices is based on the slope gradient of the track; it is necessary that such data be available to the crew and that they be well aware of it.

However, neither the local annex nor other instructions (1.10.5) include information on the slope gradients of the railway stations, so a basic input for protection against runaway cannot be known exactly. Nevertheless,

- according to their statements, the personnel know adequately the slope and slope gradients at Majláth Station;
- whatever the degree of the slope, it only affects the places and quantities of the fastening devices to be used, i.e. it will not exempt one from the obligation to use such devices (1.10.1).

2.5.2 Possibility to deviate from general rules

It may occur at a Railway Operations that it is not justified to apply general rules because of local characteristics or unconventional but effective solutions. In such cases, however, such special local rules deviating from the general rules should be included in the Local Annex, which is the management's responsibility.

The IC were not given a reason for the omission of securing devices (2.2.1.4), neither could the IC themselves give a reason for that.

The reason for the choice (deviating from the general rules) of the person to close the red-white track barrier (2.2.1.4.1) could be justified by economical work organisation, as the traffic manager has other tasks to do in connection with the closing of the working day, while the reserve locomotive driver's workload and working hours allow it (however, Section 2.2.1.4.1 contains some cons against it). It is the responsibility of the local management to make a decision in this issue, and to regulate daily work accordingly, and/or enforce compliance with the rules.

2.5.3 The personnel

2.5.3.1 Assignment of an unqualified employee

The traffic manager at work on the day preceding the occurrence (1.6.3) did not have the independence exam required for his position, he was only preparing for such exam:

- 2016: he passed the train crew exam,
- 2017: he passed the general traffic management exam,
- 2018: he performed the 'practical training under supervision' which is required for would-be traffic managers,
- he would have started the theory part of the independence course in the days following the occurrence[6], and
- could have taken the exam on completion of such course.
- (Finally, he completed the course in autumn 2018, and passed the independence exam.)

(Similarly, another colleague had also been assigned for the position of the traffic manager, but on a day not relevant for the occurrence (1.6.2).)

However, the disregarded obligations which played a role in the occurrence had already been for him from his train crew qualification and general traffic manager qualification, so the lack of the theory part of the independence training (which would have been necessary for his compliant assignment) did not in fact represent a lack of knowledge from the aspect of the occurrence.

Other traffic managers of the Railway Operations had acquired their qualifications at training courses held (without a railway instructor) within the Railway Operations prior to the effective legislation relating to training. The affected traffic manager has similar qualifications (general traffic manager, and independence training based only on the practical training received within the Railway Operations) as his colleagues; therefore, even if his assignment is not lawful, it hardly represents a direct threat to the safety of traffic.

2.5.3.2 Working times, driving times

The background for the assignment of a not fully qualified colleague and the involvement of the Head of Service in operational tasks (as mentioned on Section 2.2.1.4.3) is that the railway personnel is overloaded: the Head of Service, who makes the duty roster, said that he had not been able to plan the roster for the personnel any other way. For the same reason, the rules relating to driving times are not observed either.

According to their own calculations, the colleagues at the company headquarters organised the recruitment and training of 6 people (some recruited to replace departing staff members and some recruited as additional staff) during the two years preceding the occurrence.

After comparison of the actual and theoretical duty rosters and after consultation with those affected, the IC concluded that

- the summer traffic can really be performed with the existing headcount at the cost of increased monthly working times only (up to 240-260 hours);
- the necessity to apply an unqualified employee for a task cannot be justified clearly;
- the rules of driving times cannot be complied with.

All in all, the staff increase plan has not provided the headcount which is necessary for providing the service undertaken and announced through the timetable and which would give manageable workload.

The locomotive driver's period of rest can be provided by substitute crew who provided substitution for a round, or by longer turning times at the terminal, but the latter would require the use of one more train for providing the same level of service.

[6] Following the occurrence, the company temporarily suspended several employees, and partly for that reason, the training course was postponed to the autumn.

The duty roster is based on an annual working time, which allows a lawful increase of the working time in the summer. However, this does not change the fact that performing 12-hour working days 18 to 20 times a month are very tiresome and will increase the risk of error made by the crew, especially in a period of the busiest passenger traffic which is also the period of the highest risk level. In such situations, the company should reassess risks and limit monthly working times as necessary, even despite legal permissibility.

2.5.3.3 Organisation of recruitment

None of the managers mentioned facing an upper limit when determining a necessary headcount, so the remaining shortage of headcount can be traced back to inaccuracies in the calculation of the necessary headcount, lack of exchange of information between the company management levels, and to inadequate peer reviewing and cooperation (see also 2.5.4).

This is also suggested by the fact that, according to the colleagues at the headquarters who were organising the recruitment, they asked for opinions from the Railway Operations, but received no answer; at the same time, the managers at the Railway Operations could not present any own calculations relating to the necessary headcounts (1.12). Related activity of the Railway Operations management is analysed in more detail in section 2.5.4.

2.5.4 Behaviour of the middle management in the mirror of company culture

2.5.4.1 Workload

The above analyses also highlight that the actual manager of the Railway Operations (Operations Director) was not very much involved in the tasks of the professional management of the Operations; such responsibilities were shifted towards the Head of Service (who had the necessary qualifications and authority), adding significant additional workload to him which might have influenced the proficiency of his work.

A symptom of this is that the investigations by the operator of the occurrences mentioned in sections 1.16.3 and 1.16.4 – which were also performed by the staff member that worked also as head of service – was completed very slowly, in 5 months and in more than 10 months, respectively, instead of the required 60 days (+ 30 days if necessary).

2.5.4.2 Cooperation

During the investigation, the IC also saw signs of not full cooperation and trust between the management of the Railway Operations and the management of the Company: the former had not even been able to successfully represent justifiable demands (e.g.: 2.5.3.3), notwithstanding that the Railway Operations Manager had been able to see through remarkable development projects after starting his service (1.12), such as:

- installation of air brakes on all rolling stock (beforehand, the trains were mainly used with hand brakes);
- introduction of computerised ticketing, for the first time on a domestic narrow-gauged railway;
- placing of a hybrid propulsion diesel locomotive in service, which was unique even internationally at that time.

It seems that, despite these significant achievements, the Railway Operations Manager was not able to manage and supervise daily operation at the time of the occurrence any more. The IC sees the background reasons as follows:

At the beginning of his service, the Railway Operations Director had expressly good relations with the older colleagues working at the Technical Department at the Headquarters of the Company, and they supported him a lot with the representation of internal demands and

obtaining the necessary support from the top management. Very probably, the results achieved had not been the result solely of his effort but the result of joint efforts with those supportive colleagues who had been recognised experts in the organisation of the forestry company (1.12).

After those older colleagues retired between 2010 and 2017, no similar type of cooperation developed between him and the new, young members of the technical Department; the new colleagues came forward with new, independent ideas, and the differences of approaches became stronger. Due to that, the Railway Operations Director did not always get the support to the implementation of his ideas as earlier, or even got into a headwind sometimes. Although the formal organisational setup did not change, this situation eroded his motivation significantly. He did not even mention to the IC the development projects which were about to start: he visibly did not feel ownership of those projects (1.12).

2.5.4.3 Causes and the vision of the future

Strong differences of opinion between people who need to cooperate may originate in characteristic features of any of them, and also in non-recognition of this situation by their common superiors who then will not attempt to settle such disputes and create an atmosphere of cooperation. The company management did not detect the existing differences of views, not even those who were directly involved: the Director General also said that there had been no serious disputes (1.12).

The new Railway Operations Manager assigned in July 2018 came from the existing team of the Technical Department, so there are good chances that the earlier good relationship between the Railway Operations and the Technical Department has been restored, but the company management need to ensure that they detect possibly deteriorating working relationships.

It is also the responsibility of the company management to plan the workload of the two-member staff responsible for railway safety in such manner that they can provide safe operation of the Railway Operations, with special regard to the extra tasks required by the costly development project underway.

2.5.5 The company's criteria in function of the activity of the authorities

The control following the occurrence reviewed existence of licences and verification documents and the use (administrative compliance) of operation documents in detail, and revealed several shortcomings in that area (1.15.4). According to their report, the professional, regular performance of the activity, the actual operation (professional conformity) of the Railway Operations had not been controlled.

Based on those above, the railway company needs to focus largely on compliance with administrative expectations in order to avoid adverse judgements or possible fines resulting from controls by the competent authority (based on the findings, they have good reason to pay more attention to those issues than before). At the same time, professional conformity is not crucial from the aspect of the adverse findings of the control.

Thus, a closer look reveals that the existing practice of the authority provides neither professional conformity, nor the related safe operation, but even diverts resources from them.

But there is also an indirect effect, of course: administrative conformity requires compliant, well-organised and demanding business management. And, as a matter of course, compliant, well-organised and demanding business management will result in a more demanding approach relating to professional conformity as well.

However, not even a demanding management can achieve professional conformity if the necessary resources are diverted – especially with smaller companies where administrative and professional management are necessarily concentrated in the hands of one manager or

a small team of managers. Prioritisation will be inevitable, and almost surely, the avoiding of more obvious loss (i.e. fines and adverse judgement by the authority) will be ranked higher.

For that reason, the IC finds that kind of regulatory and administrative practice more advantageous (at least for smaller companies) in which fewer conditions are set for administrative conformity (and which, accordingly, checks for and punishes less risk of error) but pays more attention to the physical implementation of professional conformity. In connection with this, TSB already issued a safety recommendation in 2010, relating to a collision accident which occurred on the same railway system (1.16.2), which recommendation was accepted by the authority, but no sign of application of its contents was perceived during the control concerned here.

3. CONCLUSIONS

3.1 Direct causes

The direct causes of the occurrence were as follows:

a) the crew member in charge did not apply the handbrake of the wagons (2.2.1.3);
b) no securing devices were put under the wagons (2.2.1.4);
c) the track barrier was left open (2.2.1.4).

3.2 Indirect causes

Those findings relating to competences, procedures and maintenance which were in connection with the factors enumerated above:

a) the wagons were left stationary on a track which allows rolling out to the open track (2.2.1.2);
b) the traffic manager delegated his task of closing the track barrier and tolerated its being left open (2.2.1.4);
c) there is no adequate management control in place (2.2.1.4.2);
d) non-compliant practices developed at the Railway Operations are even "handed down" to new colleagues (2.2.1.5).

3.3 Root causes

Reasons that are distant in time and space which are related to the operation of the system in the regulatory environment and in the safety management system:

a) there was no substantial, effective inspection from the part of the Railway Operations management (2.2.1.4.3);
b) Following the renewal of the company management, cooperation between the management of the Railway Operations and the colleagues at the company headquarters was not smooth anymore, which led to partial passivity of the management of the Railway Operations; the top management did not recognise or/and did not manage the newly developed conflicts (2.5.4).

3.4 Other risk factors

A factor which is not related directly to the occurrence, but increases risk:

a) The Local Annex contains no data of the slope gradients of the railway stations (2.5.1);
b) no double rail skids are in place (2.2.2.1);
c) the traffic manager did not have the qualifications required in relevant legislation (2.5.3.1);
d) the headcount of the Railway Operations is insufficient (2.5.3);
e) sometimes decisions (affecting immediate technical details) which pertain to the responsibility of the Railway Operations, are made at higher level (2.3);
f) as an outcome of the activity of the authority, administrative conformity becomes a stronger criterion than professional conformity (2.5.5).

3.5 Proven procedures, good practices

It helped mitigate the consequences of the occurrence and avoid a more serious outcome that

a) even in lack of specifications, the staff assess the slope gradients correctly (2.5.1);

3.6 Lessons learnt

Safety-conscious managerial behaviour is necessary to demand that employees conform with basic safety measures – for instance, protection against breakaway in this case (2.2.1.4.2). LÁEV has good chances in this field because the technical conditions are mostly available, and the use of such technical means can easily be fit into the technology currently used (2.2.1.4).

In the case of multi-level company management (which is predominantly typical in railway transport) cooperation between the management levels is essential. It is important for the top management to recognise the lack or obstacles of cooperation and to take action to restore adequate working relationships (2.5.4). This requires special attention if railway operation is not the main activity of the company.

Even a new management can only maintain safe operation if their responsibilities are harmonised with their professional knowledge and workloads, and if their non-safety related tasks and responsibilities do not increase disproportionately either (2.5.4.1).

4. ACTIONS TAKEN

Following the occurrence, the railway company prohibited storage of rolling stock on the tracks № II and № IV at Majláth Station, and took action to enforce compliance with the rules of preventing runaway of rolling stock.

The organisational structure as well as the members of the management of the Railway Operations changed in December 2018: training of new colleagues began.

4.1 Expected actions

It is marginally related to this occurrence that a larger investment project will include, among others:

- expansion of the wagon storage shed, and
- making of a new vehicle repair workshop by reconstruction of an old building.

The latter (if appropriately equipped) may also offer a solution to the vehicle maintenance shortcomings found in connection with the occurrence investigated under number 2014-0605-5:

"The repair workshop of the railway was demolished without providing substitution for it beforehand. There are no organised vehicle maintenance processes (specifications, devices, documentation), and the equipment necessary for vehicle diagnostics is not available."

5. SAFETY RECOMMENDATION

Similar cases can be avoided by observing the rules specified for prevention of runaway of rolling stock, and the railway company has taken action to enforce such rules, and there have also been personnel changes. However, the IC calls attention to those written in the Lessons learnt section.

The IC maintains the safety recommendation issued earlier under number 2010-0464-5-01 relating to the alteration of the practice of control applied by the authority.

6. DIVERGING OPINIONS

No member of the IC expressed a diverging opinion. The IC received no diverging opinion related to the Draft Report.

Budapest, 6 September 2019

Gábor Chikán
Investigator-in-Charge

Flórián Gula
IC Member

Sárik Csaba
IC Member

Annex 1: Assessment of the speed of collision

Records from the right-hand side rear-view camera are available for assessment of the speed of the collision. Counting showed that the camera recorded 3 frames per second (60 frames in 20 seconds). Three consecutive frames taken from the record depict the situation as follows:

Figure 18: t=0

The wagon with reg. № 308 appears on the left-hand side of the frame; its corner is at the centre-line of the street (the accuracy of the subjective assessment is about 0.5 metres).

Figure 19: t=1/3 sec

The wagon reaches the edge of the platform of the tram, actually its corner has even run beyond the edge by 0.5 metres.

Figure 20: t=2/3 sec

The wagon reaches the side of the tram.

As measured by the IC, the width of the lane of the road is 3.3 m, i.e. the distance between the points identified in the first two frames is ca. 3.5 m, which means that the speed of the wagon is ca. 38 km/h.

Annex 2: Decision following control by the Authority

MINISTRY FOR INNOVATION AND TECHNOLOGY

RAILWAY AUTHORITY DIVISION

Reference №: VHF/13616-3/2018-ITM

Desk Officer: László Kolbe

Telephone number: +36 1 474 1722
Email: Laszlo.kolbe@itm.gov.hu

Subject: Decision relating to the traffic safety control at LÁEV Directorate, Északerdő Zrt.

Attachment: Notification Form

DECISION

Following the on-site traffic safety control (hereinafter: "the control") performed by Railway Authority Division, Ministry for Innovation and Technology at the premises of State Forest Railways of Lillafüred (3535 Miskolc, Erdész utca 24, hereinafter: "LÁEV") of ÉSZAKERDŐ Private Limited Company (3535 Miskolc, Deák tér 1., hereinafter: "Északerdő Zrt.") on 5 July 2018, I have made the following Decision:

I issue the following regulations to Északerdő Zrt., relating to the continued railway operation of LÁEV:

1. Each employee who is in a position which relates to the safety of railway traffic shall have a certificate of medical fitness for the given position.
   Deadline: immediately and on a continuous basis.
2. A railway vehicle driving licence shall be issued to the drivers of railway vehicles.
   Deadline: immediately.
3. Each railway vehicle driver shall have the new type of railway vehicle driving licence specified in NFM Decree № 22/2010 (XII. 20.) on railway vehicle driving licences and railway vehicle driving certificates (hereinafter: NFM Decree № 22/2010).

   Deadline: 29 October 2019.

Furthermore,

4. Each railway operation activity of LÁEV and State Forest Railway of Pálháza shall be reported separately, on the form attached, to the Transport Authority.

   Deadline: 30 September 2018

The Transport Authority reminds Északerdő Zrt. that:

- pursuant to Section 25 (6) of NFM Decree № 31/2010 (XII. 23.) on the permission of the placing in service, periodical control and official registration of railway vehicles, the railway vehicles operated on a narrow-gauged network need not have a maintenance organisation, but the operator of railway vehicles operated on a narrow-gauged network are obligated to serve data as specified in Section 25/A(1);
- The workshops performing maintenance, repair and periodical review of railway vehicles operated on narrow-gauged networks may perform such activities in possession of the technical licence issued pursuant to the NFM Decree № 24/2016 (VII. 18.) on the maintenance, repair and periodical review of railway vehicles;
- during its operation, it is obliged to immediately take all actions which are necessary for the protection of lives as well as public and private property, and for prevention of environmental and other damage, and to meet all safety requirements on a continuous basis, and shall also take full liability for the activities of its suppliers and shall control compliance of the products and services received from such suppliers.

This Decision becomes final on the date of its issuance and is non-appealable.

Petition against this Decision may be submitted for legal remedy on the ground of infringement. Such petition may be submitted to the transport authority which made the decision at first instance, but addressed to the competent court, in 3 (three) copies, within thirty days of issuance of the Decision to be reviewed. Please be advised that the court will judge the case without a hearing, but a hearing may be requested in the petition. Litigation is subject to stamp duty payable as specified by the court.

REASONS

On 5 July 2018, the Transport Authority performed on-site control at the premises of LÁEV, Északerdő Zrt. at 24 Erdész street 3535 Miskolc, with regard to Section 80(1)d) of Act CLXXXIII of 2005 on railway transport (hereinafter: the "Railway Act"). Minutes were taken of the findings of such control, the contents of such Minutes were shared; representatives of LÁEV signed such Minutes, a copy of which was then handed over to them.

The Transport Authority reviewed and found acceptable the following items:

- operation, periodical review, maintenance and repair of the railway network;
- placing in service, repair and periodical control of the railway vehicles, and the organisation responsible for maintenance;
- training and examination of employees who are in positions related to the safety of railway traffic;
- The operator's instructions, rules, documents of trains in service.

Due to the shortcomings and non-compliances revealed on-site and recorded in the Minutes, I issued the regulations indicated in the operative part above to Északerdő Zrt., relating to the railway activities of LÁEV and State Forest Railway of Pálháza, with regard to the following.

1. It was found during the on-site control that the certificate of medical fitness (№ 97945 1 27949 2017 of 13 July 2017) held by …….. applies to the Group II positions 'Traffic Manager' and 'District Inspector'.

On the basis of the document "Certificate of Basic Examination" № VVK\2018\33871\54509 of 23 02 2018, he has the qualification 'Railway Operations Manager'.

No certificate of medical fitness of …….., 'train crew member in charge' was presented during the on-site control, and the document was not available at the premises of Északerdő Zrt. either, according to their email of 13 July 2018.

Pursuant to Government Decree № 203/2009 (IX. 18.) on the medical requirements for employees in positions related to the safety of railway traffic and on the procedure for medical examination, the medical fitness of the above employees shall be certified with the appropriate Decision.

According to the statement from Északerdő Zrt., the said employee will not be employed as 'train crew member in charge' until he obtains the required certificate.

2. During the on-site control, the Transport Authority asked for the driving licence of …….., railway vehicle driver. The document was not presented because it had not been issued by LÁEV to the railway vehicle driver.

It was found that, in contrast to Section 36/D of the Railway Act the railway vehicle drivers do not hold a railway vehicle driver certificate (issued by the railway company) for the railway network used and for the railway vehicle driven.

3. During the on-site control, the Transport Authority found that the "old type" driving licence № 006522 for owner-used railway vehicles issued to ……, railway vehicle driver had expired on 15 February 2016, and no new type railway vehicle driving licence had been issued to him.

Pursuant to Section 21(3) NFM Decree № 22/2010, those railway vehicle drivers who became entitled to drive a railway vehicle prior to the effective date of the Decree and do not meet the requirements provided in such Decree may continue their activity till 29 October 2018.

4. Pursuant to Section 84/C(1) of the Railway Act, railway network operation, passenger transport service, rail freight, or carriage of goods to be performed by narrow-gauged railway may be commenced with a notification sent to the Railway Transport Authority 30 days in advance. No such notification has been submitted to the Railway Transport Authority by the affected companies so far.

Pursuant to Section 84/D(8) of the Railway Act, the Railway Transport Authority shall notify the submitting entity on the fact of receipt thereof.

I did not rely on contribution of other authorities as these proceedings did not affect their competences.

I made my Decision on the basis of my competence provided by Sections 80(1), 81(1) and (4) of Act CL of 2016 on General Administrative Procedure (hereinafter: the "ÁKR") and Section 80(1)d) of the Railway Act.

I provided the possibility to start and administrative lawsuit on the basis of Section 114(1) of the ÁKR and Section 39 of Act I of 2017 on Administrative Procedure.

I made my decision within the framework of the powers and competence provided by the Government Decree № 382/2016 (XII. 2.) on the assignment of entities carrying out administrative functions related to transport.

Budapest, 5 September 2018

[*Round stamp of the Ministry:*] **Ministry for Innovation and Technology - 132**

Signed for and on behalf
Dr László Palkovics
Minister for Innovation and Technology

[*Illegible signature*]
Levente Gémesi
Head of Department

Attachment: Notification Form

Recipients of the Decision:

1. **ÉSZAKERDŐ Zrt.**

   3525 Miskolc, Deák tér 1.

2. **LÁEV**

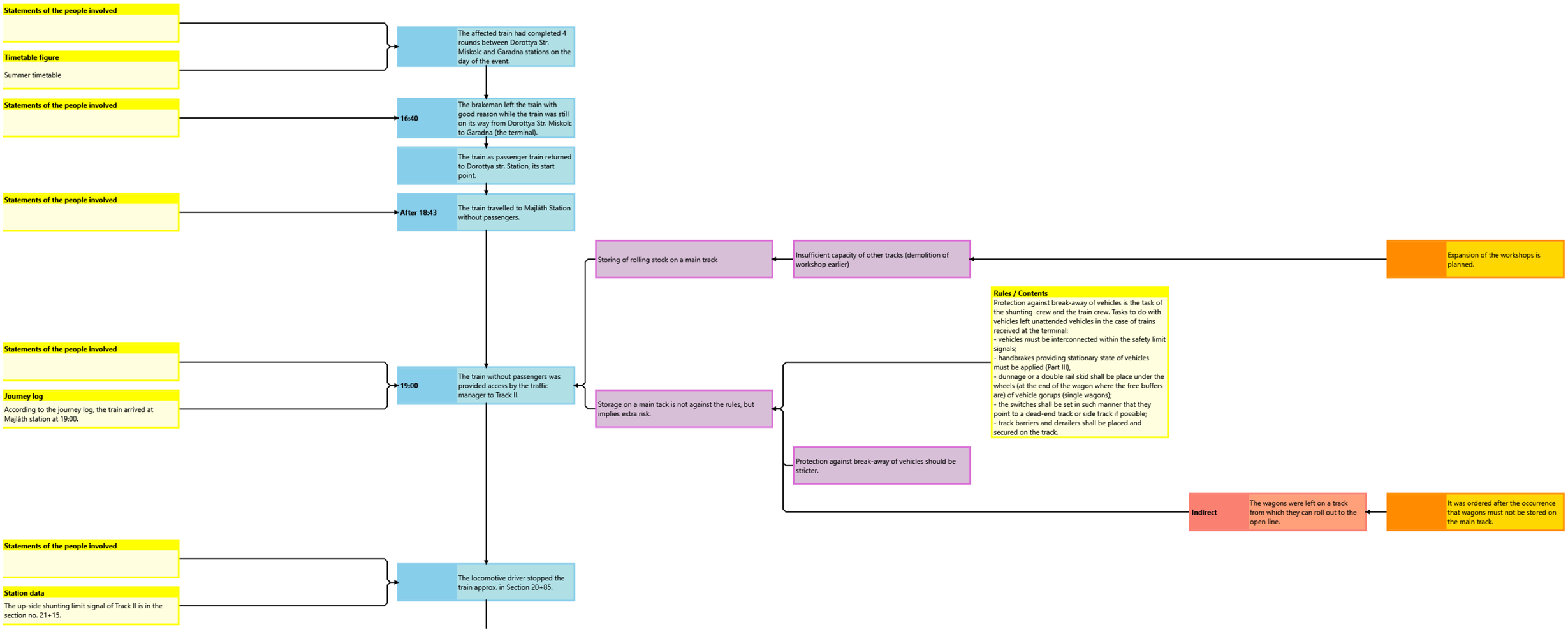
   3535 Miskolc, Erdész utca 24.

3. **Archives**

Annex 3: Timeline

The timeline of the occurrence, and the relationships between the evidences and major findings. Legend to the chart:

- the blue fields represent the timeline of the occurrence;
- the yellow fields indicate the evidence used, and the green fields contain explanations;
- the fields in magenta indicate major findings of analyses;
- the red fields contain conclusions; and
- the orange fields indicate possibilities of prevention or preventive actions already taken.



The vehicles

DSC07296.JPG: The fully released hand brake on the wagon with reg. no. 305, and a rail skid at the brake platform.

The IC found the hand brakes fully released on the wrecks. This cannot occur in consequence of the collision, but only if the wagon was not braked or the brake was released by vibration on the way.
But the latter presupposes the break-away of a braked wagon, which is unlikely (or just the brake was inadequately applied).

Statements of the people involved

A theoretical option is that the brakes were applied, but someone released it subsequently. As the airbrake was applied, such release could have happened long before the beak-away.
As the site is closed and guarded, and partly monitored by surveillance cameras, the IC gives this option very little chance. Regardless of that, property protection issues had occurred prior to the technical upgrade of security guarding.

The crew member in charge got off the wagons, but did not brake them with the hand brakes.

The train crew member in charge usually brakes the wagons; this time it did not happen.

Statements of the people involved

Direct — Tha handbrakes of the wagons were not applied.

Skill-based error, when the person performing an activity fails to take a given step, i.e. omits it.
Such omission may have various causes, e.g. fatigue or some other, unidentified cause.

Such - rare - omissions are a natural part of human activity. That is why additional protections would be needed for safe operation (e.g. rail skids, dunnage, track barrier in ourr case).

Due to airbrake mode, regular application of the hand brakes is not part of the routine anymore.
Application of the hand brakes is primarily the brakeman's task.

Statements of the people involved

Protection against break-away generally obligates the train crew to perform the task. Clear assignment of the employee obliged to perform the task is missing (it could be regulated even locally).

Rules / Contents
Shuinting master may be:
• the train crew member in charge or the crew member assigned by him/her,
• the traffic manager,
• other employee who has qualification for this task and who is assigned to this task by the traffic manager.

No automatism has developed in the brakeman to perform this task before disconnecting the train.

Accident scene / The vehicles

DSC07314.JPG: Wagon groups stored without rail skid or dunnage on Track III, Majláth station

The IC surveyed the station where 3 other groups of wagons were stored, with no rail skids placed under any of the wagons. Each group was secured only by hand brakes, with not even any air in airbrake systems of the wagons.

Statements of the people involved

Crew statements confirmed that the wagons of the trains received at Majláth station are never secured by rail skids.

Neither dunnage nor rail skids were placed under the wagons.

The use of securing devices is not part of the stopping process at Majláth station.

Direct — No securing device (dunnage, rail skid) was put under the wagon.

The Local Annex does not contain slope gradient data of the stations, but the personnel know it well.

Rules / Contents
Its Chapter 7 discusses the slope gradients of the railway track, listing the steepest slopes and 0‰ sections. It does not indicate the slope gradients at the stations.

Other — The Local Annex does not indicate the slope gradients of the stations.

Rules / Contents
Protection against break-away of vehicles is the task of the shunting crew and the train crew. Tasks to do with vehicles left unattended vehicles in the case of trains received at the terminal:
- vehicles must be interconnected within the safety limit signals;
- handbrakes providing stationary state of vehicles must be applied (Part III),
- dunnage or a double rail skid shall be place under the wheels (at the end of the wagon where the free buffers are) of vehicle gorups (single wagons);
- the switches shall be set in such manner that they poitn to a dead-end track or side track if possible;
- track barriers and derailers shall be placed and secured on the track.

Rail skids are available on the wagons as a rule, but they are used in special cases only.

Accident scene / The vehicles

DSC07296.JPG: The hand brake fully released on the wagon with reg. no. 305, and a rail skid at the brake platform.

The double rail skids required for wagons against break-away are not available.

Statements of the people involved

Rules / Contents
2 double rail skids shall be available at the stations for the purpose of holding back break-away vehicles (except where there is not even temporary service). 1 double rail skid or 2 rail skids shall be available on locomotives.

Other — No double rail skids are kept on wagons. ← Action was taken to purchase double rail skids.

The rules requires the use of the rail skid, no excuse is provided.

In the case of justified deviation, is must be recorded in the Local Annex; that is a managerial privilege and implies taking liability. (Actually, the IC received no justification for deviation.)

Rules / Contents
It contains no rules for keeping vehicles stationary.

There is no direct evidence of applying of the automated airbrake, but
- most probably, the locomotive driver used this system when stopping the train;
- when disconnecting the wagons, the crew member usually also "taps" the main pneumatic line for the sake of sufficient braking effect;
- this also a possible explanation why the wagons stayed stationary.

The locomotive driver disconnected the locomotive. The wagons remained braked by the airbrake.

Statements of the people involved

The locomotive and the crew member in charge left the wagons.

Statements of the people involved

The reserve locomotive driver closed the gates of the site, but the track barrier remained open.

Closing the gates of the site and the track barriers is an interlinked task of the traffic manager or the reserve locomotive driver.

It was just incidentally used; actually, it had not been closed during the site closing process prior to the occurrence.

Direct The track barrier was left open.

Additional data / Camera record

Statements of the people involved

The tack barrier is difficult to use.

- **Statements of the people involved**
- **Logs / Contents**

2016-2017-ben a felújítás nem volt teljeskörű, emiatt sem lehetett használni. It was incompletely reconstructed in 2016-2017, so it was not used. (The risk was recognised later no, and its reconstruction was completed.)

The management did not notice or/and tolerated the unsafe practice. A kind of consensus had developed about it.

- **Rules**
- **Statements of the people involved**

Indirect No managerial control; a manager is also involved in the non-compliant practice.

Safety-conscious managerial behaviour is necessary to demand that employees conform with basic safety measures. LÁEV has good chances in this field because the technical conditions are mostly available .

Statements of the people involved

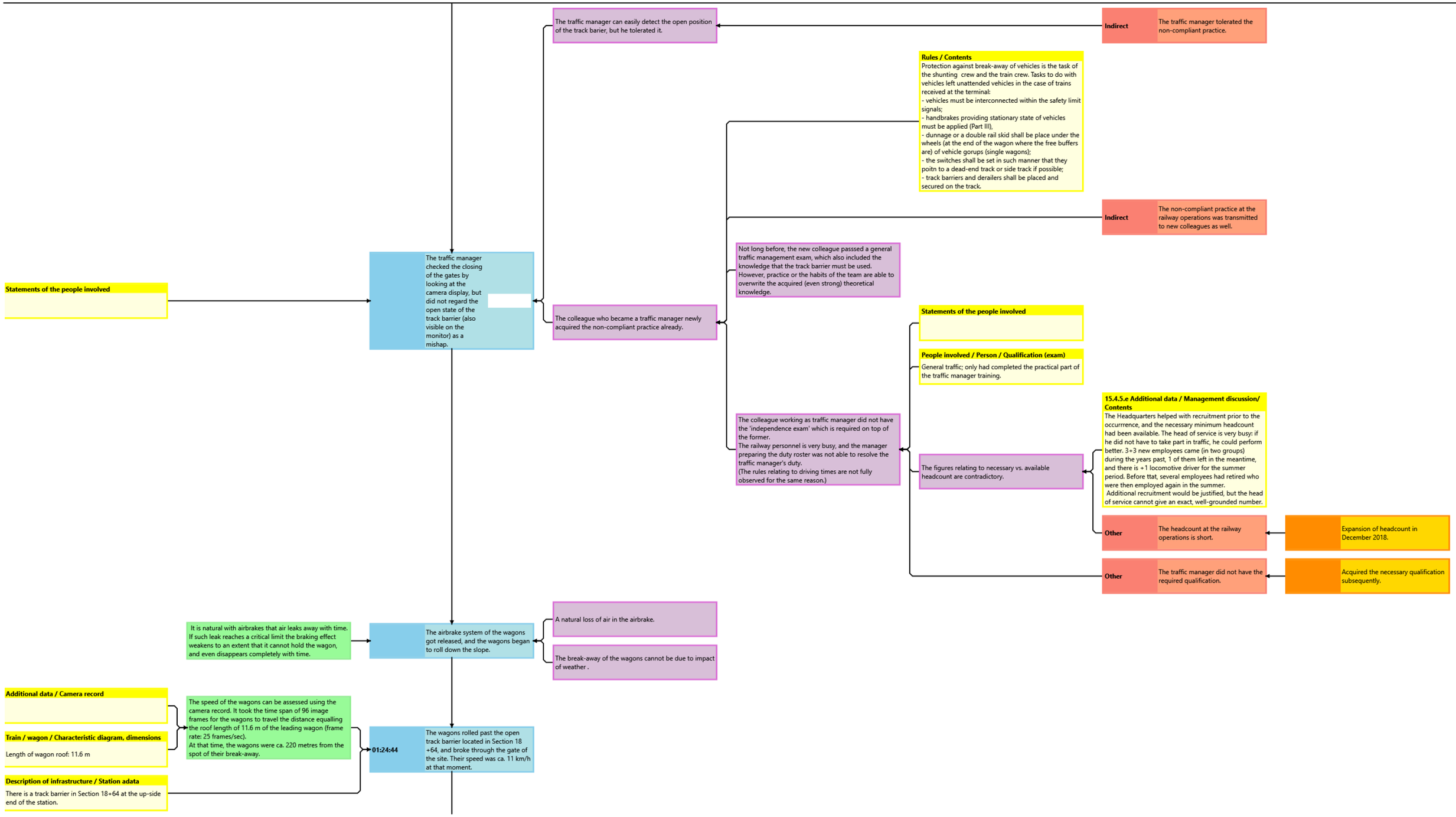
Rules / Contents
Protection against break-away of vehicles is the task of the shunting crew and the train crew. Tasks to do with vehicles left unattended vehicles in the case of trains received at the terminal:
- vehicles must be interconnected within the safety limit signals;
- handbrakes providing stationary state of vehicles must be applied (Part III),
- dunnage or a double rail skid shall be place under the wheels (at the end of the wagon where the free buffers are) of vehicle gorups (single wagons);
- the switches shall be set in such manner that they poitn to a dead-end track or side track if possible;
- track barriers and derailers shall be placed and secured on the track.

The Instruction gives a broad description, but it includes the traffic manager .

The involvement of the reserve locomotive driver is a prohibited delegation of task, unless a related specific additional regulation is provided.

The gates of the sites were always closed (security goal), but the track barrier was typically not used (safety goal).

The chance of incompletely performed work can be lowered by connecting two tasks closer physically, e.g. interdependence of keys or combination of two structures (a measure to the contrary was taken after the occurrence).


Statements of the people involved
The traffic manager checked the closing of the gates by looking at the camera display, but did not regard the open state of the track barrier (also visible on the monitor) as a mishap.
The traffic manager can easily detect the open position of the track barier, but he tolerated it.
Indirect
The traffic manager tolerated the non-compliant practice.
Rules / Contents
Protection against break-away of vehicles is the task of the shunting crew and the train crew. Tasks to do with vehicles left unattended vehicles in the case of trains received at the terminal:
- vehicles must be interconnected within the safety limit signals;
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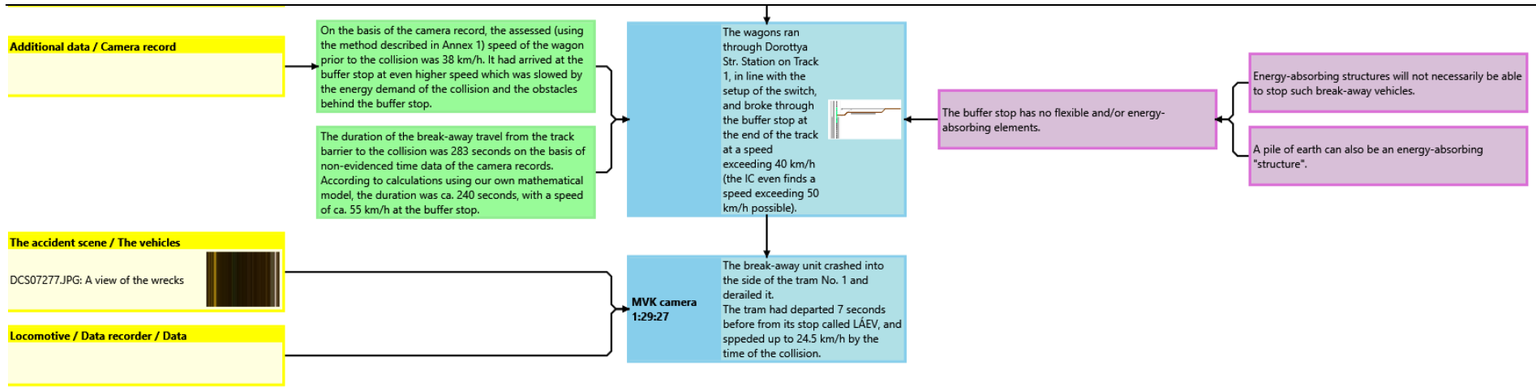
- the switches shall be set in such manner that they poitn to a dead-end track or side track if possible;
- track barriers and derailers shall be placed and secured on the track.
Indirect
The non-compliant practice at the railway operations was transmitted to new colleagues as well.
The colleague who became a traffic manager newly acquired the non-compliant practice already.
Not long before, the new colleague passsed a general traffic management exam, which also included the knowledge that the track barrier must be used. However, practice or the habits of the team are able to overwrite the acquired (even strong) theoretical knowledge.
Statements of the people involved
People involved / Person / Qualification (exam)
General traffic; only had completed the practical part of the traffic manager training.
The colleague working as traffic manager did not have the 'independence exam' which is required on top of the former.
The railway personnel is very busy, and the manager preparing the duty roster was not able to resolve the traffic manager's duty.
(The rules relating to driving times are not fully observed for the same reason.)
The figures relating to necessary vs. available headcount are contradictory.
15.4.5.e Additional data / Management discussion/ Contents
The Headquarters helped with recruitment prior to the occurrrence, and the necessary minimum headcount had been available. The head of service is very busy: if he did not have to take part in traffic, he could perform better. 3+3 new employees came (in two groups) during the years past, 1 of them left in the meantime, and there is +1 locomotive driver for the summer period. Before ttat, several employees had retired who were then employed again in the summer.
Additional recruitment would be justified, but the head of service cannot give an exact, well-grounded number.
Other
The headcount at the railway operations is short.
Expansion of headcount in December 2018.
Other
The traffic manager did not have the required qualification.
Acquired the necessary qualification subsequently.
It is natural with airbrakes that air leaks away with time. If such leak reaches a critical limit the braking effect weakens to an extent that it cannot hold the wagon, and even disappears completely with time.
The airbrake system of the wagons got released, and the wagons began to roll down the slope.
A natural loss of air in the airbrake.
The break-away of the wagons cannot be due to impact of weather .
Additional data / Camera record
Train / wagon / Characteristic diagram, dimensions
Length of wagon roof: 11.6 m
The speed of the wagons can be assessed using the camera record. It took the time span of 96 image frames for the wagons to travel the distance equalling the roof length of 11.6 m of the leading wagon (frame rate: 25 frames/sec).
At that time, the wagons were ca. 220 metres from the spot of their break-away.
01:24:44
The wagons rolled past the open track barrier located in Section 18 +64, and broke through the gate of the site. Their speed was ca. 11 km/h at that moment.
Description of infrastructure / Station adata
There is a track barrier in Section 18+64 at the up-side end of the station.


Additional data / Camera record
On the basis of the camera record, the assessed (using the method described in Annex 1) speed of the wagon prior to the collision was 38 km/h. It had arrived at the buffer stop at even higher speed which was slowed by the energy demand of the collision and the obstacles behind the buffer stop.
The duration of the break-away travel from the track barrier to the collision was 283 seconds on the basis of non-evidenced time data of the camera records. According to calculations using our own mathematical model, the duration was ca. 240 seconds, with a speed of ca. 55 km/h at the buffer stop.
The wagons ran through Dorottya Str. Station on Track 1, in line with the setup of the switch, and broke through the buffer stop at the end of the track at a speed exceeding 40 km/h (the IC even finds a speed exceeding 50 km/h possible).
The buffer stop has no flexible and/or energy-absorbing elements.
Energy-absorbing structures will not necessarily be able to stop such break-away vehicles.
A pile of earth can also be an energy-absorbing "structure".
The accident scene / The vehicles
DCS07277.JPG: A view of the wrecks
Locomotive / Data recorder / Data
MVK camera 1:29:27
The break-away unit crashed into the side of the tram No. 1 and derailed it.
The tram had departed 7 seconds before from its stop called LÂEV, and spseded up to 24.5 km/h by the time of the collision.